McCarran International Airport

Las Vegas, Nevada

Airport Traffic Control Tower Siting Study

Final Siting Report

May 2005

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Completed: 5/11/2005

EXECUTIVE SUMMARY

This report documents the study to determine the optimum location and height for a new airport traffic control tower (ATCT) facility at McCarran International Airport (LAS) in Las Vegas, Nevada. The study, conducted by the Kansas City NAS Implementation Center (ANI-540), with extensive participation by the Clark County Department of Aviation (DOA), as well as the local and regional Federal Aviation Administration (FAA) offices, has established a recommendation for the location and height of a new ATCT. This report presents background information concerning the need for a new control tower at LAS, a discussion of the siting and evaluation criteria for the new tower, an overview of all potential sites considered, a detailed evaluation of the primary siting options, and the final conclusions and recommendations. It is intended that the information contained in this report will document the actions of the Siting Team, the siting study process, and the final conclusions and recommendations.

The need for a new ATCT at LAS results from the size, age, location and height of the existing tower. The existing tower was constructed and commissioned in the early 1980's. It is centrally located between the east-west runways and the north-south runways, and has a control cab floor height of approximately 180 feet above ground level (AGL). Over the last 20 years, the number of Air Traffic positions in the control cab has increased from six to 14 to accommodate the increase in air traffic over the same period. Passenger traffic at McCarran Airport has increased from 16.3 million in 1988 to over 40 million in 2004. Due to the air traffic growth and the general development of McCarran Airport, the existing tower is constrained in its ability to accommodate the number of air traffic controllers and the equipment needed to serve air traffic control at the airport. Further, the existing tower does not currently provide controllers with optimum airfield viewing capability due to airport. In general, the existing airport traffic control tower has reached its life expectancy.

A budget item and justification for a new ATCT at Las Vegas were submitted as part of the FY02 FAA budget process. The justification cited the size and height inadequacies of the existing control cab as the main reasons for a new control tower; however, an assumption was included that a new ATCT could be constructed on the existing ATCT/TRACON site, which would allow for the utilization of the existing administrative space for the new ATCT. The associated budget estimate was $12.8M for construction and approximately $400K for electronics installation.

The siting study for a new ATCT site began in June of 2003 with the identification of six potential sites for initial evaluation. Of the six sites, three were located on the existing ATCT/TRACON plot (Site A, Site B, and Site C) in an attempt to comply with the FY02 budget justification; however, the remaining three were scattered at various locations around the airport (Terminal B, Sunset Road, and Russell Road) because the Siting Team wanted to be confident that all potential siting options were considered regardless of their proximity to the existing ATCT/TRACON site.

Early in the siting process, Terminal Approach Control Procedures (TERPS) calculations were performed to determine the maximum allowable building height at each of the six potential siting locations. At the same time, the Airways Facilities Technical Integration Laboratory (AFTIL) in Atlantic City, New Jersey generated a three-dimensional model/simulation of McCarran Airport. The TERPS results, along with the AFTIL model/simulation were used to evaluate viewing conditions from various cab heights at all of the potential sites. The model/simulation was also used to assess the shadowing impacts of the new ATCT during the construction phase while viewing from the existing control cab. The shadowing impacts of the old ATCT while viewing from the various new control cab locations were also evaluated. The use of the AFTIL model also made it possible to evaluate the effects of existing and proposed airport development.

The Siting Team, which consisted of representatives of Air Traffic, Airway Facilities, NATCA, PASS, ANI, and the DOA, visited the AFTIL in November of 2003. By utilizing the AFTIL model/simulation, two sites (Site A and Site B on the existing ATCT/TRACON site) were eliminated almost immediately because of the shadowing effects created by the new ATCT structure when viewing from the existing control cab during construction. The remaining four sites were evaluated from various control cab heights to determine the optimal viewing elevations.

Shortly after returning from the AFTIL trip, the DOA eliminated one of the remaining sites (Russell Road Site) because of planned road construction and development in the site area. To compensate for the lost site, the DOA identified a replacement site near the future Terminal 3 building. The “Terminal 3 Site” proposed by the DOA actually consisted of two sites, one on the east side of Kelly Lane and one on the west side of Kelly Lane, and both were located relatively close to the Russell Road Site. Since the proposed site on the east side of Kelly Lane was a much larger site, the Siting Team focused its efforts on the eastern property because it offered increased setback distances for security requirements, and additional space for possible future expansion of the Base Building.

Each of the remaining primary siting options (Site C on the existing ATCT/TRACON site, Sunset Road, Terminal B, and the new Terminal 3) were analyzed and evaluated in detail, following the procedures identified in FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*, as well as new criteria established by the Air Traffic Organization (ATO). The analyses involved studies of viewing capability from each of the sites, and included an evaluation of each siting option considering the criteria contained in FAA Order 6480.4. The results of these studies and analyses have been documented in this Final Siting Report.

After continuing the siting process through the early part of 2004, two developments changed the siting results. First of all, the DOA eliminated the Sunset Road Site from consideration. It was a privately owned parcel of land, and the DOA was initially willing to acquire it and lease it to FAA for the new ATCT. During the time the site was first identified until early 2004, real estate prices in the Las Vegas Valley increased considerably, and the DOA could no longer justify acquiring the property for FAA. Secondly, the DOA informed FAA that the Terminal 3 building design had been revised,

and that the structure would actually have to be moved further to the west, which placed it on the eastern half of the preferred Terminal 3 Site (east side of Kelly Lane). Because of the design changes, the usable size of the Terminal 3 Site located on the east side of Kelly Lane was decreased dramatically. At the same time, however, the DOA stated that the Terminal 3 Site on the west side of Kelly Lane could be enlarged from the original 1.5 acres to around 3.5 acres. As a result, the Siting Team shifted its focus to the Terminal 3 Site on the west side of Kelly Lane.

A small contingent of the FAA Siting Team consisting of Air Traffic and ANI returned to the AFTIL model/simulation in late July of 2004 to assess the impacts of moving the ATCT to the west side of Kelly Lane. As expected, the line-of-sight viewing of the airport and movement areas improved as the ATCT was moved further west. In fact, the final determination was to construct the new ATCT as far west on the site as possible to provide improved visibility to Taxiway D behind Terminal 2 and decrease the shadowing impact of the existing ATCT when viewing from the new cab. In addition to the viewing improvements, the larger site on the west side of Kelly Lane potentially offered increased security setback distances from the public streets, and would abut the AOA on the east and south, which inherently would offer increased security for the facility.

Based on the analyses of this study, the results of the FAA airspace and TERPS evaluations, information and feedback obtained from the AFTIL model/simulation, and a comparison of advantages and disadvantages of all of the primary siting options, the Terminal 3 Site on the west side of Kelly Lane was selected as the preferred siting option for the new ATCT. The Terminal B site was eliminated for a variety of reasons including, its proximity to a TSA baggage screening facility, restricted AOA access during construction and after commissioning, no on-site parking for FAA personnel, underground fuel lines in the vicinity, the likelihood of aircraft noise and exhaust fumes impacting FAA operations, and the general dissatisfaction with the site by several DOA offices. Site C was eliminated because of the ramifications associated with a severe lack of setback distance from public streets, the major impact to existing FAA employee parking, increased risk to existing operations during the construction phase, potential risk to the passenger tram that bisects the existing FAA site, and the lack of any future expansion capability.

In September of 2004, ANI briefed the FAA Western Pacific (AWP) Region Office of the conclusions and recommendations outlined in the Siting Report. ANI identified the Terminal 3 site on the west side of Kelly Lane, located in the southwest quadrant of the intersection of Kelly Lane and Russell Road, as the final selection. ANI informed the AWP Regional Office that the new ATCT could be constructed with a cab floor height of 289 feet AGL, providing a viewing height of 294 feet AGL, corresponding to an elevation of 2,354 feet above mean sea level (AMSL). The top of the tower structure would be approximately 324 feet AGL, corresponding to an elevation of 2,384 feet AMSL. At $50K per vertical foot of control tower (to the cab floor), the ATCT cost was estimated at $14.5M. The associated 7,500 square-foot administrative Base Building, using $250 per square foot, was estimated to cost approximately $1.875M. Because full exterior security setbacks could not be attained at the Terminal 3 Site, a 10% contingency was added to the

construction cost estimate to account for some blast hardening of both structures. With the contingency, the initial cost estimate for the ATCT and Base Building was about $18M.

Shortly after the initial Siting Report was finalized, the DOA notified FAA that a large water main was located on the southern portion of the Terminal 3 Site. The location of the water line, if left in-place, would impact the anticipated location of the ATCT and Base Building on the Terminal 3 Site, and would result in reduced security setback distances and increased blast-hardening costs. After some preliminary investigation, the DOA determined that the water line could be relocated off of the site at a cost of approximately $750K; however, it has not been determined whether FAA or DOA will pay for the relocation.

Subsequently, in October of 2004 the local FAA Air Traffic personnel noticed a new building construction project on the north end of the Terminal 2 structure. The facility was being constructed by the DOA for the Transportation Security Administration (TSA), and will be used as a baggage screening facility for Terminal 2. Unfortunately, due to the height and location of the new TSA baggage screening facility, line-of-sight visibility to Taxiway D behind Terminal 2 was severely impacted from the proposed new ATCT location with a cab floor elevation of 289 feet AGL. The Siting Team returned to the AFTIL in November of 2004 to complete the Safety Management System (SMS) exercise for the ATCT siting process, and to assess the impacts of the new TSA baggage screening facility. To establish an acceptable line-of-sight to Taxiway D behind the new TSA building, the ATCT cab floor had to be raised approximately 48 feet to 337 feet AGL. With a cab floor at 337 feet AGL, the overall structure height increased to approximately 372 feet AGL. The cost impact for the additional 48 feet was estimated at $3.0M.

As a result, ANI re-evaluated the primary siting options (Site C and Terminal B), and coordinated with the DOA to identify any possible new sites elsewhere on the airport. The Site C location, in the parking lot of the existing ATCT facility, was still deemed to be an unacceptable alternative because of the severe lack of security setback distances, impacts to the operational facility during construction, impacts to employee parking, and the conflict between seismic and blast requirements. Due to another planned DOA construction project to connect the Terminal 1 B Gates and C Gates with a sky bridge, the Terminal B Site was no longer available. The DOA actually identified one new possible site; however, it was quickly eliminated because the site is currently being used as a storm drainage detention pond and would require immense amounts of fill to accommodate construction. Also, site access would be challenging, the existing drainage pipes would have to be relocated, and ductbank access would likely be difficult and expensive.

Consequently, the only viable conclusion is to construct the new ATCT on the Terminal 3 Site on the west side of Kelly Lane. The new ATCT will be constructed with a cab floor height of 337 feet above ground level (AGL), providing a viewing height of 342 feet AGL, corresponding to an elevation of 2,402 feet above mean sea level (AMSL). The top of the tower structure would be approximately 372 feet AGL, corresponding to an elevation of 2,432 feet AMSL.

Construction of the new ATCT at the proposed Terminal 3 Site, and at the proposed height of 372 feet AGL, will not affect any approach, or missed approach surfaces and will not affect the circling minimum of 3,020 feet AMSL for McCarran Airport. Additionally, the tower and base building facility is not expected to impact any electronic equipment, navigational aids, or radar facilities.

A Comparative Safety Assessment (CSA) has been completed for the LAS ATCT siting effort. The Safety Risk Management Document, which summarizes the results of the CSA, is included in Appendix 6. The purpose of the CSA was to apply the Safety Risk Management (SRM) process, as defined in the FAA Safety Management System (SMS) Manual, to the ATCT siting process for McCarran Airport to ensure it is compliant with the goals and objectives of the FAA SMS Manual. The results of the CSA coincide with the findings of the Final Siting Report in that the Terminal 3 Site is the most favorable siting option. The Terminal 3 Site presents the most favorable safety profile of all three primary siting options, and has the lowest relative safety risk ranking.

This study was conducted by the FAA in association with the Clark County Department of Aviation. The Las Vegas Airway Facilities and Air Traffic personnel, Western Pacific (AWP) Regional Office personnel, Sierra Nevada SMO personnel, and engineering staff from the Kansas City Implementation Branch participated in the study.

Siting Report Signatures/Approval

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Regional Administrator, Western Pacific Region — Date: 7/11/05

Signature of this document indicates approval of the recommended ATCT location and height. Additional details such as space and equipment requirements will be developed during the conceptual design.

Safety Management System (SMS)
Signatures/Approval

(Safety Risk Management Document and Comparative Safety Assessment Report is located in Appendix 6)

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INTRODUCTION

The Federal Aviation Administration (FAA) is undertaking a study to determine the most suitable location and height for a new Airport Traffic Control Tower (ATCT) for McCarran International Airport (LAS) in Las Vegas, Nevada. The Kansas City National Airspace System (NAS) Implementation Center's Terminal Platform (ANI-540) is performing the siting study and will be responsible for the overall engineering and construction activities for the new LAS ATCT via a Resource Sharing Agreement (RSA) with the terminal platform from the Los Angeles NAS Implementation Center (ANI-940). This report documents the analyses and evaluations conducted during the siting study. It provides background information on McCarran Airport and the need for a new control tower, a discussion of the siting and evaluation criteria, an overview of all sites considered, and an evaluation of the primary siting options. It also presents conclusions of the siting study, and a recommendation for the location and height for the new ATCT.

Criteria used in the analyses and evaluations are based primarily on FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*, and FAA Order 6480.7d, *Airport Traffic Control Tower and Terminal Radar Approach Control Facility Design Guidelines*. These orders were supplemented by FAA Federal Aviation Regulations (F.A.R's), Advisory Circulars (AC's), and other documents from which airspace and navigational aide (NAVAID) clearance and obstruction criteria where established. In addition, a variety of other considerations not cited specifically in FAA documents were deemed to be relevant to the analyses of the potential siting options, and were included in the evaluations.

The general methodology followed in this siting study was to first identify various areas around the airport where a new ATCT could potentially be located, and then to identify specific potential site locations in these areas with respect to airfield horizontal clearance and separation standards and airspace clearance restrictions. Once the potential sites were identified, airfield viewing conditions based on line-of-sight criteria were investigated. This work led to the identification of the most feasible sites. These most feasible sites were then evaluated considering the variety of siting criteria and factors. The basic steps taken in the evaluation of each tower site were:

- Determination of minimum tower height to provide a minimum 35-minute viewing angle to existing and future runway surfaces.
- Determination of maximum possible tower height considering existing and future airspace clearance requirements.
- Determination of minimum tower height required to provide clear viewing to nearest taxiway safety area edge
- Determination of required tower height at each site, based on highest of 35-minute viewing angle height requirements and taxiway safety area viewing height

- Analysis of sight obstructions caused by buildings.
- Evaluation of the most feasible siting options in relation to the established siting criteria and other relevant factors.

Documentation of the analyses, evaluations, and conclusions of the siting study is contained in this report. The documentation is organized as follows:

Section 1 Background Information. Background information on McCarran Airport, the justification for a new ATCT, and the scope of the siting study.

Section 2 Criteria for ATCT Site Identification and Evaluation. Overview of the criteria and factors considered in the identification and evaluation of potential sites for a new ATCT facility.

Section 3 Initial Site Identification and Analysis. Discussion of initial sites identified for the new ATCT, evaluation of these initial sites, and determination of the most feasible siting options based on the initial identification and evaluation.

Section 4 Evaluation of Primary Siting Options. Analyses of most feasible siting options identified in the initial site investigations.

Section 5 Comparison of Alternatives. Summary of the advantages and disadvantages of each of the primary siting options, and comparison of the options in a qualitative fashion by means of a matrix.

Section 6 Conclusions and Recommendations. Summary of the initial conclusions of the study, overview of FAA analysis and evaluations, and presentation of final conclusions and recommendations.

1. BACKGROUND INFORMATION

1.1 General Information on McCarran International Airport

Las Vegas McCarran International Airport (LAS) is located in Clark County approximately 5 miles south of the City of Las Vegas and east of and adjacent to the "Las Vegas Strip." The McCarran airport site covers an area of approximately 3,000 acres. McCarran Field on South Las Vegas Boulevard was constructed and opened for service in December 1948. In March 1963, the terminal building and operations were relocated to its present day location on Paradise Road. McCarran is currently ranked the 7th busiest airport in the nation and is the 2nd busiest airport in terms of originating/destination passenger traffic. In 2003, McCarran accommodated approximately 36.2 million passengers and 501,000 aircraft operations. The passenger total included 35.1 million domestic and 1.1 million international travelers. In 2004, McCarran is averaging an increase of approximately 6 percent in activity. The airport is owned by Clark County, Nevada and operated under the policy direction of the Board of County Commissioners, the authority of the County Manager and the management of the Director and Deputy Director of Aviation. See Figure 1 for a vicinity map and airport layout.

The airport terminal facilities configuration consists of two terminals and four passenger concourses. Concourses A, B, C and D are accessible through Terminal 1. Concourse C and D passengers are shuttled to and from Terminal 1 by automated transit systems. Eight gates at Terminal 2 primarily service charter and international flights. The airfield configuration is currently comprised of four active runways with a supporting network of taxiways and taxi lanes connecting runways to aircraft parking and staging areas. The east-west parallel runways (RW 7 and 25) are situated south of Terminal 1 and the north-south set of parallel runways (RW 1 and 19) is located west of Terminal 2. Since the airport is bound on all four sides by major thoroughfares, housing subdivisions, and commercial developments, there are no plans for additional runways or runway extensions.

Fixed based operators and general aviation facilities are located on the west side of the airport. Air Cargo buildings and other aviation-related facilities are located on the east side.

Currently, the airport has several major projects in progress. The projects listed below, as well as others, are a part of McCarran's $1.8 billion dollar Capital Improvements Program:

1) Expansion of Satellite "D" terminal and apron,
2) Terminal One and Two ramp rehabilitation,
3) a Consolidated "Rent-A-Car" facility,
4) a Bus Maintenance facility,
5) Taxiways Z, B, W,
6) Throat area ramp and Storm Drain improvements,

7) Taxiway C extension,
8) Concourse A and B window wall replacement and HVAC upgrade,
9) In-line Baggage Screening nodes at Terminals One and Two,
10) Relocation of Russell Road and a nearby Fire Station.

1.2 Need for New Airport Traffic Control Tower

The existing ATCT was constructed in the early 1980's and was commissioned in 1983. Activity at McCarran Airport has steadily increased over the past two decades and the existing ATCT is simply not tall enough, nor the cab large enough, to accommodate the expected increase in activity in the future.

The line-of-site from the existing ATCT to several areas on the airport has been adversely impacted over the years by new construction. Visibility to the backside of Concourses A, B, and D is blocked, and aircraft moving in these areas cannot be seen from the ATCT cab. Visibility to portions of Taxiway Delta is impaired by Terminal 2 (Charter/International Concourse) as well. Future construction by the airport sponsor will further impair the line-of-sight problems at the airport.

In addition to the line-of-sight concerns, the existing control cab is too small to support the existing positions and allow for future expansion. When the ATCT was commissioned over 20 years ago, there were only 6 air traffic controller positions in the cab. Due to increased air traffic at McCarran Airport, there are currently 14 positions in the 525 square-foot cab, and the available space has been utilized beyond its capacity.

1.3 Overall Project Scope

Based on the rationale identified in *Section 1.2* above, a project scope and justification were submitted as part of the FAA budget process for the relocation of the LAS ATCT. The solution in that budget submission recommends the construction of a new ATCT shaft and utilization of the existing Base Building/TRACON facility. However, rather than take a short-sided view and only entertain potential sites on the existing ATCT plot, the Project Team, consisting of Airway Facilities, Air Traffic, ANI, and Clark County representatives, decided to focus on the most feasible sites irregardless of their proximity to the existing Base Building/TRACON facility. This approach, although more time consuming, will allow everyone involved with the project to be certain that some potentially excellent sites were not overlooked. Critical factors such as construction costs, utility costs, and/or environmental issues can then be examined to make a final determination of whether or not a site should be eliminated from consideration. This final siting report summarizes all of the information that was gathered during the siting process, and provides a final site selection recommendation.

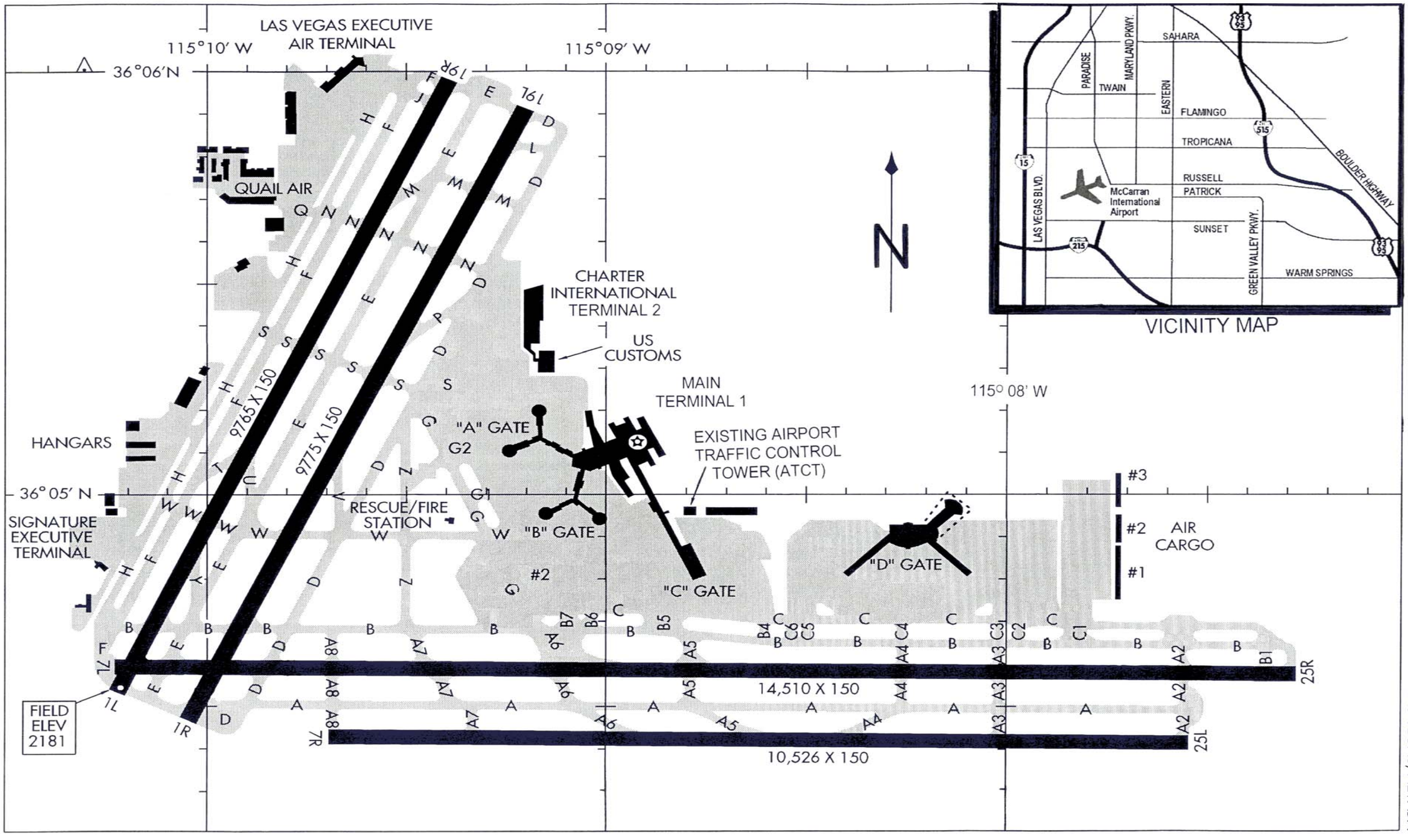

Figure 1 – Vicinity Map and Airport Layout

1.4 Historical Ceiling Height Information

A consideration relevant to the evaluation of potential tower heights is the frequency at which a tower cab is likely to be above the weather ceiling, or to have visibility impaired by the presence of fog. Based on information obtained from the Western Regional Climate Center, Desert Research Institute, low clouds and fog are not a concern in Las Vegas, Nevada. Due to its desert location, heavy fog occurs less than 1 day per year, and generally lasts for only an hour or so. A low ceiling of 200 feet or lower is likewise very rare to the point that there is no average percent of frequency.

1.5 Siting Study Scope

The siting study for a potential new LAS ATCT is focused on determining the optimum siting solution for that new tower. The siting solution consists of the facility location, the cab height, and the ability of the air traffic controllers to maximize their line-of-site to all areas of the airport. The study encompasses several tasks, including establishing siting criteria, identifying possible sites, analyzing and evaluating the sites, and developing recommendations for the new ATCT. The study considers existing and future configurations of the airport in the analysis of tower siting scenarios. It also considers other critical factors such as cost of construction, availability of utilities, and environmental issues.

This study was conducted with significant input from the Clark County Aviation Department, as well as local and regional FAA staff. The product of the study is this final siting report. As noted previously in the **Introduction**, this report documents siting criteria, the potential sites, evaluation of potential sites, airfield viewing conditions from the potential sites, and ultimately the recommendations for the new ATCT location. The study and analysis were conducted in accordance with Federal Aviation Administration Order 6480.4*, Airport Traffic Control Tower Siting Criteria*, and in coordination with the Clark County Aviation Department and the FAA.

2. CRITERIA FOR SITE IDENTIFICATION AND EVALUATION

Described below are the criteria and considerations that have been addressed in the siting study. The criteria and considerations are taken in part from FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*. As stated in Order 6480.4, the Order "sets forth the procedures to be followed, the criteria to be used, the considerations to be made, and the methods of site evaluation and site selection." The Order establishes a variety of siting requirements, some of which are "Mandatory" and some of which are "Non-Mandatory". The siting requirements contained in Order 6480.4 are provided below. The mandatory and non-mandatory requirements are listed separately. In addition to the requirements defined by Order 6480.4, there are several other siting considerations and factors that are related specifically to McCarran Airport, either separate from or extensions of requirements contained in the Order. These are also described below. In establishing the criteria and considerations to be addressed in this study, the factors and issues specific to McCarran Airport have been combined with the criteria set forth in Order 6480.4. The combination defines the siting criteria and considerations that have guided this study. This combination of criteria and considerations is summarized below, following the listing of criteria contained in the Order and the discussion of other factors and considerations.

2.1 Siting Criteria from Order 6480.4, *Airport Traffic Control Tower Siting Criteria*

2.1.1 Mandatory Siting Requirements

a. "Maximum visibility of airborne traffic patterns must be available. Primary consideration must be given to the local control position of operation; however, all operating positions must have this capability. A clear unobstructed view of the approach to the end of the primary instrument runway and all other active runways and landing areas should be available."

   Comment: This requirement must be applied to existing runways as well as possible future runways. For the McCarran ATCT, existing Runways 01R-19L, 01L-19R, 07R-25L, and 07L-25R would be considered. Due to development around the perimeter of the airport, no future runways are planned at McCarran Airport.

b. "Complete visibility must be available to all airport surface areas utilized for movement of aircraft which are under the control of the airport traffic control tower. Primary consideration must be given to the air traffic ground control position of operation; however, all operating control positions should have this capability. A clear, unobstructed and direct view of taxiways and runways should be available."

   Comment: The areas under control of the tower include the full lengths of the taxiways south and west of Terminal 1, west of Terminal 2, and the taxiways parallel to the runways.

c. "The site plot must provide sufficient area to accommodate the initial building and any planned future extensions, personnel, and facility vehicle parking, fuel storage

tanks, exterior transformers, etc., as dictated by location requirements".

Comment: One of the potential sites for a new tower at McCarran Airport will be a location in the ramp area near the B Gates of Terminal 1. For a new tower located in this area on the AOA, it would not be possible to provide personnel parking at the facility with a site at such a location.

d. "Federal Aviation Regulations, Part 77, *Objects Affecting Navigable Airspace*, including all amendments, must be complied with unless deviations are absolutely necessary to meet mandatory siting requirements given above."

Comment: Part 77 surfaces to be considered include approach and transitional surfaces for the existing and proposed runways. This requirement should be extended to include ILS approach and missed approach surfaces (TERPS) as well as Part 77 surfaces.

e. "The tower must not be sited where it will derogate the performance of existing or planned electronic facilities (ILS, TVOR, RTR, etc.)."

Comment: The functions of communication facilities, radar facilities (particularly ASDE and ASR), and existing and proposed ILS localizers will be considered.

2.1.2 Non-Mandatory Siting Requirements

a. "Depth perception of all surface areas to be controlled should be available. This is the ability to differentiate the number and type of grouped aircraft and/or ground vehicles, and to observe their movement and position relative to the airport surface areas. Perception is enhanced where the controller's line of sight is perpendicular or oblique, not parallel to, the line established by aircraft and/or ground vehicle movement, and where the line of sight intersects the airport surface at a vertical angle greater than 35 minutes".

Comment: Although the 35-minute vertical viewing angle is presented in the Order as a non-mandatory criterion, siting studies typically take the 35-minute angle as a minimum standard in calculating tower cab heights and in evaluating whether a tower will provide adequate perspective for controllers. In general, Air Traffic personnel often emphasize the value of perpendicular or oblique viewing of critical airport surfaces.

b. "The tower cab should be oriented to face north, or alternatively east, south, or west in that order of preference for control towers in the northern hemisphere. In areas where snow accumulates on the ground surface, a southern orientation should be avoided. Avoid orientations that will place a view of the runway approach in line with a rising or setting sun."

Comment: The existing tower at McCarran has considerable exposure to the southeast, south, west and northwest to Runways 25R and 25L, 19R and 19L.

Except for sun reflections off of the Mandalay Bay Hotel/Casino, discussions with LAS Air Traffic personnel indicated that the orientation of the existing tower cab is not a significant concern, despite the exposure to the south and west.

c. "Visibility should not be impaired by direct or indirect external light sources. Such sources may be ramp lights, parking area lights, and reflective surfaces."

Comment: In general, view from a tower into a terminal area with ramp and building lights mixed with aircraft and vehicle lights presents one of the most difficult situations for air traffic controllers. At McCarran Airport the presence of the brightly lit hotels and casinos along Las Vegas Boulevard just to the west of the airport further complicates this issue. It is safe to assume that any tower location that provides good line of site to taxiways and runways at McCarran would be affected by the hotel/casino lighting.

d. "Visibility should be available for all ground operations of aircraft and to airport ground vehicles on ramps, apron and tie-down areas, and test areas."

Comment: Generally, it is desired that a tower provide visibility of as much operational area as possible. In practice, it is often not possible to provide full visibility of ramp and apron areas, due to terminal and concourse buildings as well as aircraft fuselages and tails.

e. "Consideration must be given to local weather phenomena to preclude restrictions to visibility due to fog or ground haze."

Comment: Fog and low cloud ceilings are not of particular concern at McCarran Airport. The desert climate precludes the area from fog and low ceilings to the extent that historical data is typically not recorded.

f. "Exterior noise should be at a minimum and sites should be evaluated through a comparison of expected noise levels at each location."

Comment: Any location for the tower on the airfield could have a significant effect on noise exposure, although the existing ATCT is located within 1,000 feet of the nearest C Gates and 1,500 feet of the nearest B Gates. With the exception of the Terminal B site, all of the other potential siting locations would offer approximately the same, or increased, distance to the nearest gates.

g. "Access to the site should avoid crossing areas of aircraft operations."

Comment: The viability of this will depend on the location of the optimum tower site. A site located in the B Gate area would be accessed across the AOA. To minimize traffic across the AOA in this situation, and to preserve the maximum possible apron area for aircraft parking and servicing, parking for personnel could not be provided at the facility.

h. "Consideration should be given to planned airport expansion as shown on the airport master plan. Particular attention should be given to future construction of buildings, hangars, new or extended runways and taxiways, etc. to preclude the necessity for relocation of the control tower at a future date."

Comment: The future construction of additional D Gates, Terminal 3, and a new Ramp Control Tower will all be considered. Due to the development around the airport, there are no plans to extend the existing runways or construct new runways at McCarran Airport.

i. "The tower should be sited in an area which is relatively free of jet exhaust fumes and impairments to visibility such as industrial smoke, dust and fumes."

Comment: Jet exhaust would be a potential concern for any tower site located on or very near an aircraft parking apron. Experience with towers located on aprons, such as at Lambert International Airport in St. Louis, Missouri, has shown that jet exhaust can be drawn into the ventilation system if the system is not carefully planned and designed. Separate from aircraft and vehicle exhaust fumes, industrial smoke, dust and other fumes are not expected to be significant issues at McCarran Airport.

2.2 Other Siting Considerations

In addition to the criteria set forth by Order 6480.4, several other considerations need to be addressed in the tower siting study. These other considerations include the following:

a. Airspace Clearances: The Order refers to Part 77 airspace constraints. Other airspace limitations, particularly the ILS approach and missed approach surfaces, must also be considered. A tower must not be at a location or height that would conflict with approach or missed approach surfaces. Conversely, if the best option for siting a tower would have an effect on approach or missed approach surfaces, minimums would need to be raised, adjusting the surfaces upward. This is not desirable in general, and is not considered a likely outcome of the LAS ATCT tower siting study.

b. Accessibility of Utility Services: A tower must be located where utility services such as water, sewer, power, telephone, and natural gas can be provided. A tower location must also allow for connections to airfield lighting circuits, NAVAID's, and other electrical and electronic facilities and equipment necessary to the function of the tower.

c. Site Development Costs: The costs of developing the site for a new tower need to be considered as a part of the siting study process. Site development costs can vary substantially from one potential site to another. Costs can be influenced significantly by topography and geologic conditions. Costs can also be influenced

by the presence of improvements that would need to be removed, and of course by soil contamination that would need to be mitigated.

d. Site Security: Security of the tower and support facilities needs to be considered in the identification of potential tower sites. Security of the facilities is generally a function of providing a buffer between the facilities and public roadways, public parking areas, and other locations to which the public has access. Security measures for an ATCT, as for any FAA facilities, will need to be approved by the FAA. The siting study should conduct a preliminary review of conditions that could affect the security of any potential tower site under consideration.

e. Environmental Considerations: Environmental considerations associated with any potential tower site must be evaluated. Ultimately, an Environmental Assessment will need to be conducted for the preferred site(s). For the purposes of the siting study, a cursory review of environmental conditions associated with potential tower siting options will be useful.

2.3 Summary of Siting Criteria and Considerations

Based on the siting criteria established by Order 6480.4, and on additional factors as summarized above, the primary siting criteria and considerations proposed for this study are as follows:

1. ***Sight from Tower***:

a. The tower must provide clear, unobstructed view of all movement areas. Movement areas consist of taxiways on south and west sides of Terminal 1, the west side of Terminal 2, and all airfield areas beyond these taxiways. Aircraft parking aprons will not be considered movement areas, and visibility of apron areas from a tower will not be a major factor.

b. Analyses of site obstructions will primarily consider buildings. For the analyses, it is assumed that shadows cast by parked aircraft would be acceptable on taxiways but would not be acceptable on runways.

c. The tower cab must be at an elevation sufficient to ensure that the vertical angle of every line of sight to airport surfaces will be at least 35 minutes at the airport surface. Existing and possible future airport surfaces must be considered in the analysis of cab elevations. Possible future airport surfaces will include taxiways, aprons, and future runways.

d. To the extent possible, sighting from the tower must not be hampered by existing or possible future ramp lighting, building lighting, or other external light sources. Locations of existing and possible future light sources must be considered in the evaluation of potential sites.

2. Compatibility with Airspace Constraints

The tower must be outside or below Part 77 transitional surfaces and approach surfaces, and outside or below all TERPS surfaces. TERPS surfaces include those based on current instrument approaches to McCarran Airport as well as potential future instrument approaches. Although it is not expected to be an impact at Las Vegas, a new tower may affect the existing circling height minima.

3. Compatibility with Navigational Aids and Radar

The tower must not interfere with the proper functioning of navigational aids and radar equipment on the airport. Existing and possible future facilities must be considered.

4. Site Access

Accessibility to the site must be considered. For landside sites, it must be possible to provide sufficient access and egress for personnel to and from the public road system, and sufficient access for official vehicles to the airfield. For airside sites (on the AOA), where parking of employee vehicles would not be allowed, the means of access for personnel must be considered.

5. Site Security

The tower site must afford sufficient security, as established by FAA security requirements.

6. Site Area

The tower must be located where the site will be of a size sufficient to accommodate the long-term site needs of the facility. Potential building expansions and other onsite equipment and support items must be considered. Vehicle parking and circulation must be considered for those sites where parking could be provided.

7. Site Support

Site support, consisting of utilities and essential services, must be available at any potential site. Utilities and services will include sanitary sewer, domestic and fire protection water, electrical power and telephone, and natural gas if natural gas is to be used as a fuel source. Additionally, connections to existing and future airfield lighting circuits and navigational equipment must be reasonably achievable. The distances to the locations at which such connections can be made will be important considerations in the evaluation of potential tower sites.

8. Compatibility with Future Airport Development

The site must be compatible with the future development of the airport. As noted, the objective of this study is to ensure that a future tower facility will be compatible with the development of the airport, and conversely that the development of the airport will be compatible with the tower. Analysis of potential tower sites must consider the existing airport facilities as well as possible future facilities including airfield improvements, terminal expansions, and cargo building and apron development.

9. Site Environmental Considerations

Environmental conditions of the site must be compatible with an ATCT. Any existing conditions not compatible would need to be mitigated for a site to be viable.

10. Site Development Costs

The costs of developing an ATCT site will vary between potential sites. Earthwork, structural requirements dictated by ground conditions, distances to utility and airfield circuit connections, and site accessibility during construction are some of the factors that influence cost. The height of tower required at a site is also a factor. Ultimately, for similar functionality, a site with the lowest development costs would, of course, be preferable. Comparisons of major site development factors enable a comparative assessment of site development costs for various siting options.

3. INITIAL SITE IDENTIFICATION AND ANALYSIS

The objective of the initial site identification and analysis was to locate available parcels of land of sufficient size to support a new ATCT, and possibly an administrative base building. Although the project justification in the FAA budget recommends a new ATCT be constructed on the existing ATCT/TRACON site, the Project Team wanted to investigate all potential sites on the airport prior to eliminating any of them.

To begin the process, the FAA coordinated with the Clark County Aviation Department to find as many potential sites as possible. As a result, seven sites were selected for initial consideration. One was located on the south side of the airport, while the other six were more centrally located between the existing runways. Of the six centrally located sites, three of those were located within the existing ATCT property boundaries. During the analysis process, the Clark County Aviation Department determined that one of the centrally located sites (Russell Road) would not be a viable option because of planned construction and street relocation in the area. The Russell Road Site was eliminated from further consideration; however, another nearby site (Terminal 3 Site), was identified by the Clark County Aviation Department, and added to the list. The Terminal 3 location actually consisted of two possible siting options, an east site and a west site; however, the east site was initially preferred and became the focus of this siting report because of its larger size.

After the initial sites were identified, they were all submitted for a preliminary Terminal Approach Procedures (TERPS) evaluation. The intent of the preliminary evaluation was to determine the maximum allowable structure height at each site so that the siting study would not entertain ATCT heights that violated Part 77 surfaces, approach surfaces, missed approach surfaces, or circling minimums for the airport.

Since airfield viewing is the most critical aspect of a potential ATCT site, the seven potential sites were then analyzed with respect to airfield viewing capabilities. To assist with this analysis, the FAA utilized the technology and expertise of the Airway Facilities Technical Information Laboratory (AFTIL) in Atlantic City, New Jersey. The AFTIL collected topographical data of all McCarran Airport surfaces including building footprints and heights. With this information in-hand, they generated a three-dimensional (3-D) computer model of McCarran Airport and the surrounding airspace. They utilized the 3-D model and special software to simulate typical air traffic operations for McCarran Airport including arrivals, departures, aircraft movements on taxiways, and aircraft movements in the ramp areas. After the computer model and simulation were completed, the information was illuminated onto a series of ten projection screens that were arranged in a 360-degree panoramic pattern. The model, simulator, and projection system created a “virtual control cab” that could be moved to any location and any height inside the model, and was an extremely effective tool for evaluating each site. In addition, a helicopter was also used to confirm the results of the model by viewing the airport from each of the sites at various heights above the ground.

3.1 Initial Site Identification

The initial siting study identified seven potential sites on and around the airport for initial analysis. They are generally described as follows, and are shown in Figure 2.

Existing ATCT Property: The existing ATCT and Base Building are situated on a parcel of property that is approximately 345 feet by 290 feet. The property is leased from the Clark County Aviation Department and includes a chain link fence around the entire complex. The fence has an automatic security gate at the northeast corner of the lot that utilizes a card reader and intercom system to control access. There are approximately 116 parking spaces within the fenced boundary, and an elevated electric tram bisects the site. The tram is approximately 20 feet above the parking lot and shuttles passengers between Terminal 1 and the D Concourse.

Site A – This site is located in the northwest corner of the existing parking lot and is depicted in Figure 3. While this site is centrally located with respect to the east-west and north-south runways, and would potentially offer optimum viewing capability to all runways and taxiways, the construction activity would be complicated by the close proximity of the elevated tram and restricted site access. Construction deliveries and staging would be a major concern due to the limited access and available space. Semi-tractor trailer maneuverability, especially turn-around space, would have to be accommodated which could include site modifications and/or street relocations. Almost 70% of the on-site FAA employee parking spaces could be lost to accommodate the construction activity and the building footprint.

Site B – This site is located in the center of the existing parking lot near the Base Building loading dock access drive, and is depicted in Figure 3. This site, similar to Site A, would potentially offer optimum viewing capability to all runways and taxiways. The construction activity would be complicated by the very close proximity of the elevated tram and restricted site access. Construction deliveries and staging would be a major concern due to the limited access and available space. Semi-tractor trailer maneuverability, especially turn-around space, would have to be accommodated which could include site modifications and/or street relocations. Almost 70% of the on-site FAA employee parking spaces could be lost to accommodate the construction activity and the building footprint.

Site C – This site is located in the northeast corner of the existing parking lot near the chain link fencing entrance gate and is depicted in Figure 3. This site, similar to Sites A and B, would potentially offer optimum viewing capability to all runways and taxiways. The construction activity would be complicated by the close proximity of the elevated tram, restricted site access, and the nearby baggage tunnel just to the west of the ATCT site. Construction deliveries and staging would be a major concern due to the limited access and available space. Semi-tractor trailer maneuverability, especially turn-around space, would have to be accommodated which could include site modifications and/or street relocations.

Figure 2 – Initial Site Locations

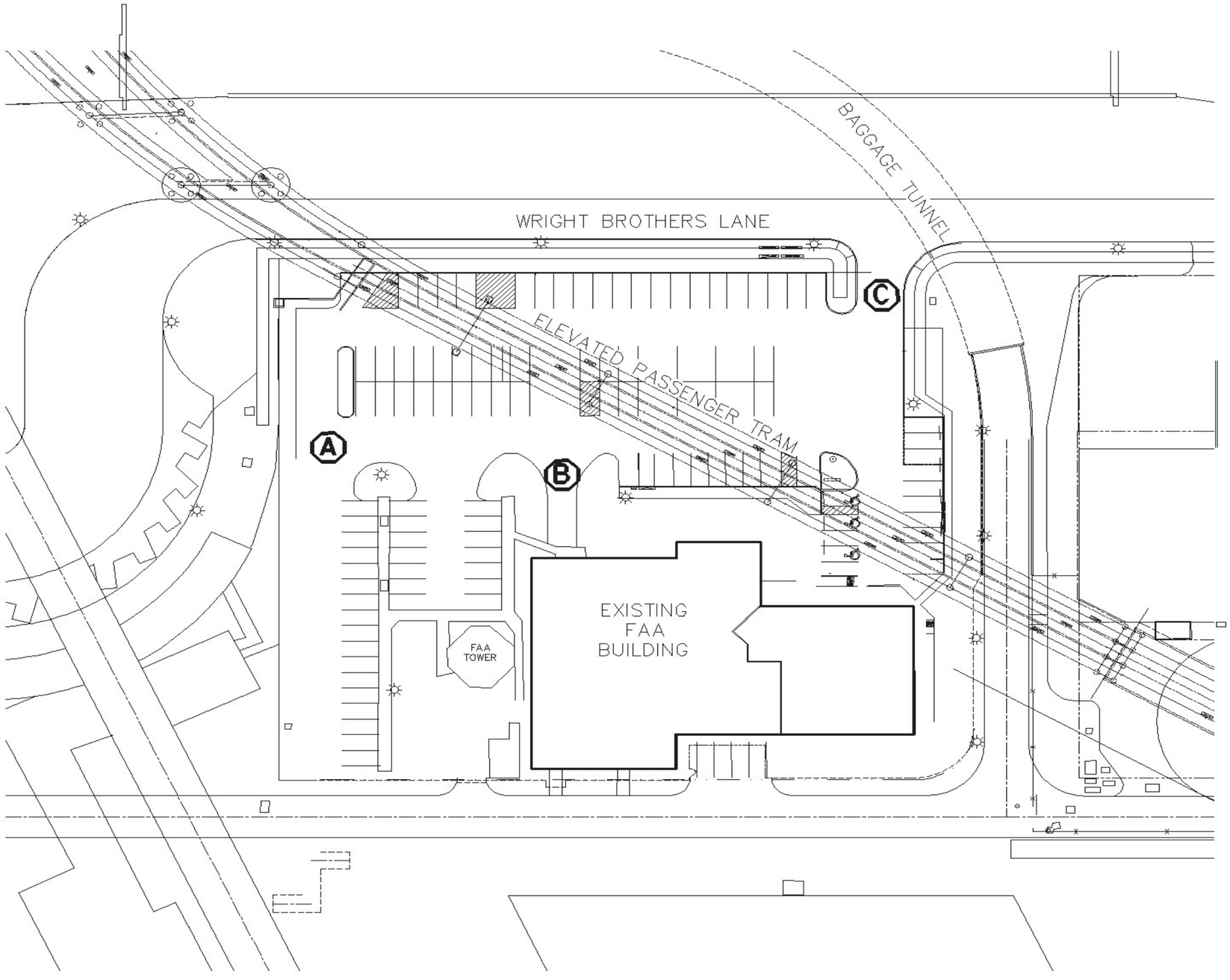

Figure 3 – Existing ATCT Site Showing Locations of Sites A, B, and C

Almost 70% of the on-site FAA employee parking spaces could be lost to accommodate the construction activity and the building footprint. Also, the entrance gate through the chain link perimeter fence would have to be re-located.

Sunset Road: This site is located on the south side of Sunset Road, which runs along the southern boundary of the airport. The proposed site is a vacant lot approximately 1,200 feet west-southwest of the existing Remote Transmitter Receiver (RTR) facility, and is located in a light industrial/commercial business park. This site would minimize the viewing distances to the east-west runways as well as the southern approach end of the north-south runways. The viewing distance to the northern end of the north-south runways, however, would be maximized. Line-of-sight to all taxiways and most ramp areas would potentially be optimized from this site. It is of sufficient size to support the ATCT shaft as well as a small administrative Base Building, and employee parking. Construction activities on this site would have very little impact on the existing ATCT and TRACON, as well as the airport itself.

Terminal B: This site is located on the Air Operations Area (AOA) in the ramp just west and north of Gate B-9 of Terminal 1. The Transportation Security Administration (TSA) is planning to construct a baggage screening facility in this area, and Gates B-3, B-4 and B8 have already been closed to accommodate the structure. This site is centrally located with respect to the east-west and north-south runways, and would minimize viewing distances to all runway ends. Line-of-sight to all taxiways would potentially be optimized from this location, but the line-of-sight to ramp areas would potentially be hindered near the base of the ATCT shaft. The site is of sufficient size to accommodate the ATCT shaft and a small administrative Base Building; however, due to its location on the AOA, employee parking would not be allowed near the facility. Construction activities on this site would have very little impact on the existing ATCT and TRACON.

Russell Road: This site is located near the intersection of Paradise Road (the main ingress/egress road for McCarran Airport) and the new Russell Road location (Russell Road will be relocated to accommodate Terminal 3 construction). This site is centrally located with respect to the east-west and north-south runways, and would minimize viewing distances to all runway ends. Line-of-sight to all taxiways would potentially be optimized from this location. The site is of sufficient size to accommodate the ATCT shaft as well as a small administrative Base Building and employee parking. Construction activities on this site would have very little impact on the existing ATCT and TRACON, as well as the airport itself.

Terminal 3: This site is located near the intersection of Kelly Lane and the current Russell Road location (on the east side of Kelly Lane). After Russell Road is re-located to the north, the area will be leveled for the future construction of Terminal 3. This site is centrally located with respect to the east-west and north-south runways, and would minimize viewing distances to all runway ends. Line-of-sight to all taxiways would potentially be optimized from this location. The site is of sufficient size to accommodate the ATCT shaft as well as a small administrative Base Building and

employee parking. Construction activities on this site would have very little impact on the existing ATCT and TRACON, as well as the airport itself.

Incidentally, there is a site available on the west side of Kelly Lane in the same location that would have the same basic advantages/disadvantages as the site on the east side of Kelly Lane described above. As mentioned earlier, the east site was initially preferred due to the larger plot of available land, which would be desirable for security setback distances and future expansion capabilities.

3.2 Analysis of Initial Sites

3.2.1 Minimum Viewing Heights for 35-Minute Angle

As discussed in the siting criteria summary, the FAA has established that an ATCT should be tall enough to ensure that the lines-of-sight to all airport surfaces have vertical angles of at least 35 minutes. This angle is the minimum needed to provide adequate perspective and depth perception for controllers. Accordingly, the viewing height that would be required to obtain the minimum 35-minute site line angle was calculated for each site. The calculations considered each end of each of the four runways at McCarran Airport. The viewing heights necessary to provide the minimum 35-minute vertical sight line angle to all airport surfaces were considered the “minimum” viewing height; however, this “minimum” is not related to the viewing height required to provide a clear view of all aircraft movement areas (e.g. the viewing height needed to avoid movement area shadowing). Table 1 depicts the minimum viewing heights calculated for each sight line to each runway end for each proposed tower site.

POTENTIAL ATCT SITE w/GROUND ELEVATION (MSL)		RUNWAY DATA	RUNWAY 01R-19L		RUNWAY 01L-19R		RUNWAY 07L-25R		RUNWAY 07R-25L	
			01R	19L	01L	19R	07L	25R	07R	25L
		THRESHOLD ELEV (MSL)	2174	2076	2178	2081	2177	2031	2155	2046
		RUNWAY LENGTH (FT)	9,770		9,770		14,505		10,525	
		RUNWAY SLOPE (FT/FT)	-0.0100	0.0100	-0.0099	0.0099	-0.0101	0.0101	-0.0103	0.0103
		ANGULAR SLOPE (min.)	-34.38	34.38	-34.03	34.03	-34.72	34.72	-35.41	35.41
EXISTING ATCT PROPERTY	**A** Base El. 2089	Distance to Threshold (FT)	6,745	5,910	7,340	6,580	7,150	8,160	5,365	7,280
		Minimum Viewing Elevation Required (MSL)	2175	2195	2180	2213	2178	2197	2154	2195
		Approx. Minimum Viewing Height (AGL)	86	106	91	124	89	108	65	106
	B Base El. 2089	Distance to Threshold (FT)	6,810	5,950	7,410	6,640	7,206	8,085	5,420	7,215
		Minimum Viewing Elevation Required (MSL)	2175	2196	2180	2214	2178	2195	2154	2194
		Approx. Minimum Viewing Height (AGL)	86	107	91	125	89	106	65	105
	C Base El. 2089	Distance to Threshold (FT)	7,000	5,905	7,590	6,605	7,405	7,965	5,630	7,100
		Minimum Viewing Elevation Required (MSL)	2175	2195	2180	2214	2178	2193	2154	2191
		Approx. Minimum Viewing Height (AGL)	86	106	91	125	89	104	65	102
SUNSET ROAD Base El. 2160		Distance to Threshold (FT)	3,450	10,460	4,215	10,750	4,340	11,705	2,460	10,200
		Minimum Viewing Elevation Required (MSL)	2175	2287	2179	2297	2177	2268	2155	2255
		Approx. Minimum Viewing Height (AGL)	15	127	19	137	17	108	-5	95
TERMINAL B Base El. 2100		Distance to Threshold (FT)	5,935	5,580	6,460	6,140	6,250	9,170	4,730	8,215
		Minimum Viewing Elevation Required (MSL)	2175	2189	2180	2204	2178	2217	2154	2214
		Approx. Minimum Viewing Height (AGL)	75	89	80	104	78	117	54	114
RUSSELL ROAD Base El. 2060		Distance to Threshold (FT)	8,510	4,400	8,975	5,265	8,730	8,340	7,360	7,865
		Minimum Viewing Elevation Required (MSL)	2176	2165	2181	2187	2178	2200	2154	2207
		Approx. Minimum Viewing Height (AGL)	116	105	121	127	118	140	94	147
TERMINAL 3 Base El. 2060		Distance to Threshold (FT)	9,065	6,230	9,640	7,040	9,440	7,210	7,720	6,700
		Minimum Viewing Elevation Required (MSL)	2176	2202	2181	2222	2178	2177	2154	2183
		Approx. Minimum Viewing Height (AGL)	116	142	121	162	118	117	94	123

Table 1 – Minimum Viewing Elevations and Heights for Minimum 35-Minute Angle

3.2.2 *Maximum Allowable ATCT Heights*

The maximum allowable height of an ATCT at any location will be subject to constraints of airspace clearances. To define these constraints, airspace surfaces were determined. The critical surfaces are approach and missed approach surfaces as defined by TERPS and RNAV, and circling minimum surfaces as defined by TERPS. It should be noted that all of the potential ATCT sites were analyzed with respect to the transitional surfaces defined in FAR Part 77, *Objects Affecting Navigable Airspace*. The FAR Part 77 Horizontal Surface, set at 150 feet above the Airport Reference Point, was not considered a constraint because airport traffic control towers at major airports typically extend above this surface. In the determination of TERPS approach and missed approach surfaces, all CAT I Instrument Landing System (ILS) were evaluated, considering existing instrument approaches on all existing runways. The circling minimum calculations were based on the circling minimum of 3,020 feet AMSL, and a 300-foot obstruction clearance. There are currently no CAT II or CAT III ILS approaches at McCarran Airport, and none are likely to be necessary due to the lack of inclement weather.

Using the airspace surfaces determined as summarized above, the maximum allowable tower height under each of the relevant surfaces was calculated for each site. Table 2 presents the maximum allowable height calculated for each site under each surface. The maximum allowable height represents the total structure height, including all appurtenances that would be possible without affecting the pertinent surface.

POTENTIAL ATCT SITE		BASE ELEVATION (MSL)	ILS Missed Approach Surfaces		Circling Minimum		Part 77	
			Maximum Elevation (AMSL)	Maximum Height (AGL)	Maximum Elevation (AMSL)	Maximum Height (AGL)	Maximum Elevation (AMSL)	Maximum Height (AGL)
EXISTING ATCT PROPERTY	A	2,089	2,410	321	3,020	931	2,368	279
	B	2,089	2,410	321	3,020	931	2,366	277
	C	2,089	2,410	321	3,020	931	2,375	286
SUNSET ROAD		2,160	2,520	360	3,020	860	2,239	79
TERMINAL B		2,100	2,460	360	3,020	920	2,408	308
RUSSELL ROAD		2,060	2,390	330	3,020	960	2,627	567
TERMINAL 3		2,060	2,396	336	3,020	960	2,481	421

Table 2 – Maximum Allowable Tower Heights

3.3 Summary Comparison of Initial Sites

A summary comparison of all seven initial sites is provided in the matrix of Table 3. The comparison matrix summarizes a variety of factors and considerations pertinent to the ATCT siting analysis, including cab height and shadowing conditions, distance to runway thresholds, site access, and primary viewing orientation.

3.4 Identification of Primary Siting Options

Based on a review of the initial analysis of sites, discussions with FAA and Clark County Department of Aviation personnel, and results from the model/simulation at the AFTIL in Atlantic City, New Jersey, three sites were identified for further analyses and evaluation. The three sites include Site C (existing ATCT property – near the security gate), the Terminal 3 Site (east side of Kelly Lane), and the Terminal B Site. The selection of these three sites stemmed largely from the better airfield viewing conditions that would be offered from these locations as well as the minimized shadowing impact by the new ATCT structure during construction while still viewing from the existing ATCT cab.

As cited previously, the Terminal 3 Site actually consists of two potential sites – one on the east side of Kelly Lane and one on the west side of Kelly Lane. The two sites are located less than 200 feet apart. This siting report focuses on the east site (2.5 acres) because it is considerably larger than the proposed west site (1.5 acres). With the exception of the size, each of the two Terminal 3 sites would offer the same operational advantages/disadvantages; therefore, the sites could be considered virtually interchangeable.

3.5 Elimination of Unfavorable Sites

The four sites that were eliminated from further consideration were removed for different reasons. The Russell Road site was removed at the request of the Clark County Aviation Department. Due to the relocation of Russell Road and future construction in the area, they determined that no viable parcel of land would be available for development by FAA for an ATCT. Sites A and B on the existing ATCT property were eliminated after viewing the AFTIL model/simulation. The model/simulation clearly showed that a new ATCT constructed in either location would severely shadow the final approach and touchdown areas of Runways 19R and 19L while viewing from the existing ATCT cab. Although the shadowing would have only been an issue once the new construction progressed above the existing cab level until commissioning of the new ATCT, the impact to the air traffic controllers was deemed to be too severe even for an interim period. Lastly, the Sunset Road Site, which was the only off-airport site, was eliminated due to a marked increase in real estate prices over the past few months. Because of the higher prices, the Clark County Aviation Department could not justify a land deal with the property owner, and the FAA could not pursue purchasing the property outright.

3.6 Airfield Viewing/Shadow Analysis of Primary Siting Options

Shadow analyses, consisting of analyses of the airfield areas that would be unobservable from a control tower at a given site for a given viewing height, are a critical element of the evaluation of potential tower sites. Based on the accuracy and effectiveness of the AFTIL model/simulation, it was determined that shadow analyses would only be performed on the primary siting options. The results of the shadow studies are included in Appendix 2. Shadow diagrams are included for the following conditions:

Existing ATCT - eye height at 185 feet AGL (2,274 feet AMSL)

Site C - eye height at 200 feet AGL (2,289 feet AMSL)
Site C - eye height at 265 feet AGL (2,354 feet AMSL)

Terminal B Site - eye height at 200 feet AGL (2,300 feet AMSL)
Terminal B Site - eye height at 254 feet AGL (2,354 feet AMSL)

Terminal 3 Site - eye height at 250 feet AGL (2,310 feet AMSL)
Terminal 3 Site - eye height at 294 feet AGL (2,354 feet AMSL)

The shadow analyses must be based on feasible tower heights. The three factors related to the optimum tower height – the minimum height needed for the minimum 35-minute vertical sight line angle, the maximum allowable height based on airspace constraints, and the height needed for ideal viewing conditions – were evaluated based on the calculations described in the foregoing. A comparison of the three factors for each site shows that the heights needed for the 35-minute viewing angle would be, as expected, substantially lower than the heights needed for ideal viewing conditions. The comparison also shows that the heights needed for ideal viewing conditions are below the maximum allowable heights. This was found to be the case at all three potential sites, although an ATCT constructed at the Terminal 3 Site for ideal viewing conditions appears to be very close to the maximum allowable tower height allowed by TERPS evaluations.

For the purposes of creating a baseline to evaluate the airfield shadowing conditions from the three primary sites, shadows were first generated for the existing ATCT, which has a viewing elevation of 185 feet AGL (2,274 feet AMSL). The problem areas are evident from this location, especially when viewing Taxiways D and N behind the Terminal 2 building. From Site C at an elevation of 200 feet AGL (2,289 feet AMSL), the existing ATCT creates a shadow across the threshold of Runway 7R and does not improve the line-of-sight viewing to Taxiway D or N behind Terminal 2. From an elevation of 265 feet AGL (2,354 feet AMSL) at Site C, the viewing to the trouble areas, as well as the entire airport, is dramatically improved. At this elevation, viewing over top of the existing ATCT and Terminal 2 is achieved. From the Terminal B Site at an elevation of 200 feet AGL (2,300 feet AMSL), the existing ATCT creates a shadow across the threshold of Runway 25R; however, all other airport surfaces are visible.

From an elevation of 254 feet AGL (2,354 feet AMSL) at the Terminal B Site, the threshold of Runway 25R is visible because viewing is over top of the existing ATCT. From the Terminal 3 Site at an elevation of 250 feet AGL (2,310 feet AMSL), the existing ATCT creates a shadow across the touchdown area of Runway 7L, and does not allow complete line-of-sight viewing to Taxiways D and N behind Terminal 2. From an elevation of 294 feet AGL (2,354 feet AMSL) at the Terminal 3 Site, the line-of-sight problems have been eliminated by allowing viewing over top of the existing ATCT and Terminal 2.

Potential ATCT Sites		Location	Minimum Height 35 min. viewing angle (Note 1)	Maximum Allowable Height (Note 2)	Shadowing Conditions	Greatest Distance to Runway Threshold	Site Accommodations
EXISTING ATCT PROPERTY	A	Centrally located on airport. Northwest corner of existing ATCT/TRACON parking lot.	2213 AMSL (124 feet AGL) Runway 19R	2410 AMSL (291 feet viewing height)	Significant shadowing at 200 feet AGL. Very minimal or no shadowing at 265 feet AGL.	8,160 feet to Runway 25R	New ATCT with link to existing Base Bldg/TRACON. On-site parking for employees after construction is complete.
	B	Centrally located on airport. Middle of existing ATCT/TRACON parking lot near loading dock.	2214 AMSL (125 feet AGL) Runway 19R	2410 AMSL (291 feet viewing height)	Significant shadowing at 200 feet AGL. Very minimal to no shadowing at 265 feet AGL.	8,085 feet to Runway 25R	New ATCT with link to existing Base Bldg/TRACON. On-site parking for employees.
	C	Centrally located on airport. Northeast corner of existing ATCT/TRACON parking lot.	2214 AMSL (125 feet AGL) Runway 19R	2410 AMSL (291 feet viewing height)	Significant shadowing at 200 feet AGL. Very minimal to no shadowing at 265 feet AGL.	7,965 feet to Runway 25R	New ATCT with link to existing Base Bldg/TRACON. On-site parking for employees.
SUNSET ROAD		South side of airport. Approximately 2,500 feet south-southeast of threshold of Runway 7R	2297 AMSL (137 feet AGL) Runway 19R	2520 AMSL (330 feet viewing height)	Shadowing not a concern. Depth percemption to 19R and 19L a problem at lower viewing heights	11,705 feet to Runway 25R	New ATCT with new administrative Base Building. On-site parking for employees.
TERMINAL B		Centrally located on airport. Near B Gates of Main Terminal. On the AOA.	2217 AMSL (117 feet AGL) Runway 25R	2460 AMSL (330 feet viewing height)	Significant shadowing at 200 feet AGL. Very minimal to no shadowing at 254 feet AGL.	9,170 feet to Runway 25R	New ATCT with new administrative Base Building. No on-site parking for employees.
RUSSELL ROAD		Centrally located on airport. Near intersection of Paradise Road and relocated Russell Road.	2207 AMSL (147 feet AGL) Runway 25L	2390 AMSL (300 feet viewing height)	Significant shadowing at 250 feet AGL. Very minimal to no shadowing at 294 feet AGL.	8,975 feet to Runway 01L	New ATCT with new administrative Base Building. On-site parking for employees.
TERMINAL 3		Centrally located on airport. Near intersection of Kelly Lane and existing Russell Road. Near Future Terminal 3.	2222 AMSL (162 feet AGL) Runway 19R	2396 AMSL (306 feet viewing height)	Significant shadowing at 250 feet AGL. Very minimal to no shadowing at 294 feet AGL.	9,640 feet to Runway 01L	New ATCT with new administrative Base Building. On-site parking for employees.

Table 3 – Summary Comparison of Preliminary Siting Options

Potential ATCT Sites		Personnel Access	Viewing Orientation	Comments
EXISTING ATCT PROPERTY	A	Potential off-site parking during construction and on-site parking after construction.	All directions; however, very minimal to the northeast	Good viewing from 265 feet AGL. Difficult construction site. Impacts viewing from existing cab.
	B	Potential off-site parking during construction and on-site parking after construction.	All directions; however, very minimal to the northeast	Good viewing from 265 feet AGL. Difficult construction site. Impacts viewing from existing cab.
	C	Potential off-site parking during construction and on-site parking after construction.	All directions; however, very minimal to the northeast	Good viewing from 265 feet AGL. Difficult construction site.
SUNSET ROAD		On-site parking and direct access to ATCT	West, north, and east primary. Minimal to south.	Largest site. Good ramp visibility. Maximizes distance to Runway 19R/L
TERMINAL B		No on-site parking and access via Main Terminal	All directions; however, very minimal to the northeast	Very good visibility of airport surfaces at 254 feet AGL. AOA location creates problems.
RUSSELL ROAD		On-site parking and direct access to ATCT	All directions; however, very minimal to the northeast	Centrally located. Good visibiity of airport at 294 feet AGL. Large site.
TERMINAL 3		On-site parking and direct access to ATCT	All directions; however, very minimal to the northeast	Centrally located. Good visibiity of airport at 294 feet AGL. Large site.

Note 1 - Minimum height shown is minimum viewing height, based on a 35-minute verical viewing angle.

Note 2 - Maximum allowable height is determined from airspace constraints (approach and missed approach surfaces) withouth adjustments and includes the entire structure; "Viewing Height" means total structure height minus 30 feet

Table 3 – Summary Comparison of Preliminary Siting Options *(Continued)*

4. EVALUATION OF PRIMARY SITING OPTIONS

The following sections provide evaluations of the three primary siting options that remained after the initial siting analysis. The three primary siting options are Site C, Terminal 3, and Terminal B. The evaluations include a brief description of each site, and an assessment of each site with regard to the siting requirements established in FAA Order 6480.4, *Airport Traffic Control Tower Siting Criteria*, and other considerations described in earlier sections of this report.

4.1 Site C

4.1.1 Site Description

Site C is located in the northeast corner of the existing ATCT/TRACON property. A new ATCT would be constructed in the parking lot near the existing entrance gate of the security fence that surrounds the leased property, and would require the entrance gate to be relocated. An ATCT constructed at this location would potentially offer excellent line-of-sight to all runways and taxiways, as well as most ramp areas. Because it is centrally located, this site would also minimize the sight distances to the ends of all of the runways. Site C would allow the utilization of the existing Base Building/TRACON for administrative and operational needs, and some type of link would likely connect the two structures.

The characteristics of Site C include the following:

- The site is located approximately 2,500 feet north of the centerline of Runway 7L-25R and 4,225 feet east of the centerline of Runway 1R-19L.

- Distances from Site C to the runway thresholds are:

01R – 7,000 feet	19L – 5,905 feet
01L – 7,590 feet	19R – 6,605 feet
07L – 7,405 feet	25R – 7,965 feet
07R – 5,630 feet	25L – 7,100 feet

As part of the initial analysis, an Airspace Study (Standard FAA Form 7460-1, *Notice of Proposed Construction or Alteration*) was conducted for Site C. The following information was submitted:

Latitude:	36° 04’ 59.61”
Longitude:	115° 08’ 47.68”
Site Elevation:	2,089 feet AMSL
Total Structure Height:	300 feet AGL
Overall Height:	2,389 feet AMSL

The conclusions of the airspace study by the San Francisco Airports Division Office show that there are no objections to an ATCT structure of the submitted height at the proposed location.

Construction of an ATCT at Site C would be very challenging and create the most impacts to the existing ATCT/TRACON as well as FAA employees. The proximity of the elevated tram that carried passengers from Terminal 1 to the D Concourse, as well as the baggage tunnel to the east, and Wright Brothers Lane to the north all combine to create a very confined work site. A construction expert from Jacobs Engineering investigated the existing site, along with its restrictive parameters, to determine the feasibility of constructing a new ATCT there. A copy of the constructability report is included in Appendix 3. The conclusions from the report are summarized as follows:

- There will be a premium of approximately 50% due to 1) positioning of the crane as well as lack of an adequate staging area for construction materials; 2) meeting security requirements; 3) protecting the elevated passenger tram and baggage tunnel; 4) accommodating construction traffic; and 5) sustaining FAA operations during construction.

- Of the 116 existing parking spaces, approximately 80 spaces would likely be eliminated during the construction phase of the project to provide the contractor with limited on-site parking, material staging, and construction trailer space. Parking for displaced FAA employees would likely be in the airport parking garage, which is located near Terminal 1. The walk from the garage to the front door of the Base Building would take approximately ten minutes.

Also, the report from Jacobs Engineering states that the seismic requirements for Las Vegas would require steel framed construction, which is more elastic during a seismic event. The blast requirements would tend to require very thick concrete walls, which produce a very rigid structure. This type of rigid structure is not compatible with the seismic design and the report states "*It appears that the project cannot be designed to meet both sets of criteria with the limitations imposed by this site"*.

4.1.2 Site C Tower Height Requirement

The minimum tower viewing height needed to provide a 35-minute viewing angle to all airfield surfaces was calculated to be approximately 125 feet above ground level. The corresponding elevation would be 2,214 feet AMSL. The total ATCT height would be approximately 155 feet above ground level, assuming a 30-foot height of tower cab roof structure, antennas, air terminals, or other appurtenances above the viewing height (35 feet above the cab floor height). The top of the tallest tower appurtenances to accommodate the minimum tower viewing height would be at 2,244 feet AMSL.

Since the Project Team did not want to waste time and effort entertaining tower heights that were unreasonably tall, a preliminary TERPS analysis was completed to establish the maximum allowable tower height at Site C. Based on that analysis, the maximum

allowable tower height (to the tallest appurtenances) was calculated to be 321 feet above ground level (2,410 feet AMSL).

Based on the AFTIL model/simulation, the tower viewing height needed to provide full visibility to all runways and taxiways was determined to be 265 feet above ground level. The corresponding elevation would be 2,354 feet AMSL. The total ATCT height would be approximately 295 feet above ground level, assuming a 30-foot height of tower cab roof structure, antennas, air terminals, or other appurtenances above the viewing height (35 feet above the cab floor height). The top of the tallest tower appurtenances would be 2,384 feet AMSL, which is 56 feet below the maximum allowable tower elevation of 2,410 feet AMSL at this location.

4.1.3 Site C Siting Criteria Evaluation – Mandatory Requirements

a. Maximum Visibility of Airborne Traffic Patterns: An ATCT constructed at Site C would provide full visibility of all airborne traffic patterns, including aircraft approaches to, and departures from, all existing runways. Due to the existing airport layout and the surrounding development there are no plans to extend existing runways or add new runways at McCarran Airport.

b. Complete Visibility of Airport Movement Area: Complete visibility of all airport movement areas cannot be achieved at a viewing height of 200 feet AGL (2,289 feet AMSL). The existing ATCT would potentially block visibility to the threshold/touchdown area of Runway 7R and the line-of-sight to Taxiway Delta would be impaired by Terminal 2, especially for smaller aircraft.

   Complete visibility of all airport movement areas can be achieved at a viewing height of 265 feet AGL (2,354 feet AMSL). The areas that were a concern at 200 AGL are not a concern at this elevation, which allows viewing over the top of the existing ATCT and Terminal 2. Visibility to all gates and ramps is not possible at this elevation; however, these areas are controlled by Clark County Aviation Department and there are no plans to turn this function over to FAA.

c. Sufficient Site Area to Accommodate Existing and Future Facilities: As stated earlier, constructing a new ATCT on Site C will be challenging. The elevated tram that shuttles passengers from Terminal 1 to Concourse D bisects the existing ATCT site and will restrict/impact the construction activities for the new ATCT. Precautions will be necessary to ensure the tram is not damaged or impacted by construction activities. Wright Brothers Lane to the north of the site and an underground baggage tunnel to the east will further complicate the construction activities. Also, FAA employee parking will be impacted for two to three years during the construction and installation phases of the project. Off-site parking for about 86 vehicles would have to be identified and secured before starting construction. After commissioning of the new ATCT, further impacts to FAA parking will last up to two years until the old ATCT structure is demolished.

d. Compliance with FAR Part 77: A tower constructed at Site C would not interfere with Part 77 runway approach, primary, or transitional surfaces; however; a tower of a functional height would extend above the Part 77 horizontal surface which would be 2,331 feet AMSL (150 feet above the Airport Reference Point). To stay below this point a tower at Site C would not offer acceptable airfield viewing capabilities.

e. Derogation of Existing or Planned Electronic Facilities: A cursory review of existing FAA facilities on and around the airport does not raise any concerns with respect to constructing a new ATCT at Site C. The systems that were considered included the RTR, VORTAC, ASDE, ASR and RCL. Further examination is required to determine if a new ATCT constructed at Site C would interfere/block the existing RCL path, and if the RCL path could be re-established with antennas mounted on the new ATCT. Once a final site is selected, an in-depth analysis will have to be conducted by FAA to ensure that no electronic facilities/equipment would be adversely impacted by the new ATCT.

4.1.4 Site C Siting Criteria Evaluation – Non-mandatory Requirements

a. Depth Perception to Controlled Surfaces: A tower constructed at Site C with a viewing height of 265 feet AGL (elevation 2,354 feet AMSL) would provide a minimum vertical angle of 35-minute to all controlled surfaces.

b. Orientation of Tower Cab: Site C is centrally located between the east-west and north-south runways so airfield viewing will range from the north-northeast counterclockwise around to the east-southeast. Airborne traffic patterns will require 360-degree viewing from the tower cab; however, viewing will be minimal to the northeast while all other directions will be prominent.

c. Visibility Impairment by External Light Sources: The hotel/casino lights on the Las Vegas Strip could impact Viewing to the west and northwest. Because of the magnitude of lighting associated with the hotels and casinos, this impact will be common at virtually every site.

   During certain times of the year, reflections from the sun off of the Mandalay Bay hotel/casino will be a concern, especially during the early morning hours when the sun is low in the eastern sky. This impact will likely be common at virtually every site sometime throughout each year.

d. Visibility of All Ground Operation Areas: Visibility of all ground movement areas would be provided from an ATCT at Site C with the exception of some ramp areas from an elevation of 265 feet AGL (2,354 feet AMSL). As mentioned earlier, viewing of the ramp areas is not an issue because these areas are controlled by Clark County Aviation Department and there are no plans to turn this function over to FAA.

e. Visibility Restrictions Due to Local Weather Phenomena: No weather phenomena

exist that would particularly affect viewing conditions from a tower at Site C in comparison to the other potential sites. Research of historical weather data show that fog and/or low ceiling conditions, which could impact taller towers, are basically non-existent at McCarran Airport because of its desert location.

f. Exterior Noise Conditions: Due to its proximity to the existing ATCT, a tower at Site C would experience very similar aircraft noise. Site C is located approximately 1,500 feet from the B Gates and less than 1,000 feet from the C Gates. Due to the distance from ramp/taxiway areas to the ATCT, the noise impact to the ATCT should be minimal.

   The noise generated by construction vehicles could impact the existing operations in the TRACON and ATCT cab. Some vibration could be expected in the existing facilities as well.

g. Site Access: Access to Site C would be via public streets into and on the airport, and very similar to how the existing ATCT/Base Building site is accessed. The current on-site parking would be impacted by construction activities, and additional off-site parking for FAA employees would be required.

   Access for construction vehicles, especially semi-tractor trailers, can be accommodated; however, the Clark County Aviation Department would have to approve any proposed changes to existing roads and/or traffic patterns. Semi-tractor trailer access will be difficult; however, it could be established with some site modifications, revisions to existing traffic patterns, or combination of both.

h. Consideration of Planned Airport Expansion: Long-term future development of the airport, including Concourse D, Terminal 3, and the TSA security building has been considered in this siting study.

i. Smoke, Dust and Exhaust Fume Conditions: The likelihood of aircraft or ground vehicle exhaust fumes contaminating the new ATCT ventilation system, or air quality in the facility is very low. Site C is not on the AOA of the airport, therefore, no special precautions should be required for the HVAC system(s).

   Separate from aircraft and vehicle exhaust fumes, industrial smoke, dust and other fumes are not expected to be significant issues at McCarran Airport. There is a possibility that construction activities for the new ATCT may affect the existing ATCT and TRACON, while the demolition activities for the old ATCT may affect the TRACON and new ATCT.

4.1.5 Site C Siting Criteria Evaluation – Other Considerations

a. Airspace Clearances: An ATCT constructed at Site C could have an overall maximum structure height of 321 feet (2,410 feet AMSL) without impacting missed approach surfaces or circling minimums.

b. Accessibility of Utility Services: Access to all necessary utilities is readily available at Site C. The existing ATCT/Base Building is approximately 100 feet from Site C and utilities could be extended to the new ATCT in an efficient and economical manner. These utilities include water, sanitary sewer, storm drainage, electricity, natural gas, and telephone.

c. Fiber Optic Cable Loop: There is currently a FAA fiber optic cable loop project underway at McCarran Airport that will interconnect all of the FAA facilities on the airport. The cable loop project is currently in the final engineering stages and actual construction is scheduled for completion in March of 2005. The cable loop can easily be extended to the new ATCT location, because it is already designed to encompass the existing ATCT/TRACON facility.

d. Site Security: The new ATCT would be protected by a perimeter fence (chain link), and a controlled access entrance gate; however, Site C is less than 50 feet from the public street (Wright Brothers Lane) that runs in front of the existing ATCT/Base Building. The recommended exterior setback (distance to perimeter of FAA site) of 300 feet cannot be met, and the interior setback distance (closest edge of FAA parking lot) of 100 feet will likely not be attained either. The ATCT structure will likely require “hardening measures” due to the increased blast pressures resulting from the reduced setback distances. The extent of those measures will have to be determined by a qualified blast consultant.

   During the construction phase of the project, additional guard force staffing in excess of the current FAA Order 1600.6B requirement would likely be necessary to mitigate the risk of construction vehicles and personnel operating so close to the existing ATCT and TRACON. Exterior security features such as cameras and card readers may have to be relocated or repositioned to ensure adequate protection for the operational facility.

   Another risk-mitigating feature that should also be considered is reducing access on Wright Brothers Lane. This could be accomplished by installing a new barrier and card reader as far away as possible (to the east) on Wright Brothers Lane, and rerouting the Southwest Airlines cargo facility (just west of existing ATCT site) traffic off of Wright Brothers Lane and onto the main airport road for departing flights.

e. Site Development Costs: The expected site development costs for Site C would likely be higher due to the confined nature of the site. The existing parking canopies would have to be removed before construction and re-installed at the conclusion of construction. The elevated tram would require structural protection due to the overhead construction activities in close proximity to the tram. An area in the median north of Wright Brothers Lane would have to be structurally prepared (cleared, leveled, compacted, etc) for setting up a tower crane. Also, Wright Brothers Lane will likely require some minor modifications to allow semi-tractor trailer ingress/egress, and traffic flow. Lastly, careful structural consideration and

design would be required to ensure the ATCT foundation would not put undue pressure/stress on the baggage tunnel to the east of the site. Extension of utilities at Site C would likely be cheaper than any of the other potential sites due to the close proximity of the existing lines.

f. Environmental Data: A preliminary Phase I Environmental Due Diligence Audit (EDDA) showed that the existing ATCT and Base Building/TRACON were constructed in the early 1980's. Since the FAA has been in control of the property for over 20 years, and we do not typically engage in activities that require the handling of hazardous materials, the potential for contamination of the air, soil, or ground water around Site C is low. Construction of the new ATCT is not expected to produce any contamination. Based on the preliminary Phase One EDDA, a Phase Two EDDA would not be required for Site C.

g. Risk Management: Constructing an ATCT at Site C will pose a higher risk to the existing ATCT and TRACON facilities, as well as the airport roads and elevated tram that carries passengers to and from Concourse D. Although the risk is perceived to be low, a construction accident (such as a lost load from the crane, or collapse of the crane) has the potential to interrupt service to the control tower, TRACON, airport ingress/egress roads, and/or the passenger tram. The severity of the interruption would be solely dependent upon the severity of the accident. In this situation, the financial impacts to FAA or airport operations would be difficult to calculate; however, due to the number of air carriers at McCarran and the number of passengers traveling to and from Las Vegas each day, the costs could be very high.

   There is also an increased risk of interrupting the tower and TRACON operations by disturbing/disconnecting an existing utility line that feeds those facilities. Due to the number of service lines on the site this risk is perceived to be medium in nature and the direct impact to the FAA facilities would be dependent upon the type of utility that was affected and the degree of damage imposed.

h. Airport Tenant Manual: As mentioned previously, Site C is located on airport property; therefore, the Airport Tenant Manual that is published, maintained, and enforced by the Clark County Aviation Department would apply to an ATCT constructed at this site. Complying with the manual could potentially have a fiscal and/or schedule impact to the project.

i. Seismic vs. Blast Design Requirements: The seismic requirements and soil conditions for Las Vegas would likely warrant steel-framed construction for elasticity and flexibility of the ATCT structure; however, the blast requirements would likely stipulate thick, heavy concrete walls that can resist blast over-pressures. This would create a very rigid structure, which would be in direct conflict with the seismic requirements. Unless the security requirements are relaxed, it does not appear that both sets of criteria (seismic and security) can be met at Site C.

4.2 Terminal 3 Site

4.2.1 Site Description

The primary Terminal 3 Site is located in the southeast quadrant of the intersection of Kelly Lane and Russell Road. It is triangular shaped and approximately 2.5 acres in size. A new ATCT constructed at this Terminal 3 Site would be centrally located between the runways, and would potentially offer excellent line-of-sight to all runways and taxiways, as well as most ramp areas. Because it is centrally located on the airport, this site would generally minimize the sight distances to the ends of all of the runways, but more so to Runways 25R and 25L.

A second potential Terminal 3 Site is located just 200 feet to the southwest of the primary Terminal 3 Site on the west side of Kelly Lane. The property originally offered by the Clark County Aviation Department as a possible second site at Terminal 3 was considerably smaller than the primary (east) site; therefore, the eastern site was considered more desirable and was the focus of this Siting Report. All of the information and findings contained in this report concerning the Terminal 3 Site pertain directly to the primary siting option (east side of Kelly Lane). Since the two potential sites are in such close proximity to each other, the information and findings contained in this report for the east site would be virtually identical and directly applicable to the site on the west side of Kelly Lane.

The characteristics of the primary Terminal 3 Site include the following:

- The site is located approximately 4,000 feet north of the centerline of Runway 7L-25R and about 5,700 feet east of the centerline of Runway 1R-19L.

- Distances from the Terminal 3 Site to the runway thresholds are:

01R – 9,065 feet	19L – 6,230 feet
01L – 9,640 feet	19R – 7,040 feet
07L – 9,440 feet	25R – 7,210 feet
07R – 7,720 feet	25L – 6,700 feet

As part of the initial analysis, an Airspace Study (Standard FAA Form 7460-1, *Notice of Proposed Construction or Alteration*) was conducted for the Terminal 3 Site. The following information was submitted:

Latitude:	36° 05’ 08.47”
Longitude:	115° 08’ 26.19”
Site Elevation:	2,060 feet AMSL
Total Structure Height:	325 feet AGL
Overall Height:	2,385 feet AMSL

The conclusions of the airspace study by the San Francisco Airports Division Office show that there are no objections to an ATCT structure of the submitted height at the proposed location.

Since the Terminal 3 Site is dislocated from the existing Base Building/TRACON, it would require the construction of a base building adjacent to the new ATCT for administrative and ancillary functions. Based on preliminary input from Air Traffic and Airway Facilities, and the Air Traffic Organizations (ATO), the estimated space allocations below could be expected for LAS ATCT:

Administrative Space	6,000 SF
Ancillary Support Space (Electrical, Mechanical)	1,500 SF
Total Base Building Size	7,500 SF

This is an estimated figure for cost comparison purposes only. If the Terminal 3 Site is selected, an in-depth space calculation, in accordance with the ATO/ATB-300 Facility Space Standard, will be required to determine final allowable size for the Base Building.

4.2.2 Terminal 3 Site Tower Height Requirement

The minimum tower viewing height needed to provide a 35-minute viewing angle to all airfield surfaces was calculated to be approximately 162 feet above ground level. The corresponding elevation would be 2,222 feet AMSL. The total ATCT height would be approximately 192 feet above ground level, assuming a 30-foot height of tower cab roof structure, antennas, air terminals, or other appurtenances above the viewing height (35 feet above the cab floor height). The top of the tallest tower appurtenances to accommodate the minimum tower viewing height would be at 2,252 feet AMSL.

Since the Project Team did not want to waste time and effort entertaining tower heights that were unreasonably tall, a preliminary TERPS analysis was completed for the Terminal 3 Site to establish the maximum allowable tower height. Based on that analysis, the maximum allowable tower height (to the tallest appurtenances) was calculated to be 336 feet above ground level (2,396 feet AMSL).

Based on the AFTIL model/simulation, the tower viewing height needed to provide visibility to all runways and taxiways was determined to be 294 feet above ground level. The corresponding elevation would be 2,354 feet AMSL. The total ATCT height would be approximately 324 feet above ground level, assuming a 30-foot height of tower cab roof structure, antennas, air terminals, or other appurtenances above the viewing height (35 feet above the cab floor height). The top of the tallest tower appurtenances would be 2,384 feet AMSL, which is 12 feet below the maximum allowable tower elevation of 2,396 feet AMSL at this location.

4.2.3 Terminal 3 Siting Criteria Evaluation – Mandatory Requirements

a. Maximum Visibility of Airborne Traffic Patterns: An ATCT constructed at the Terminal 3 Site would provide full visibility of all airborne traffic patterns, including aircraft approaches to, and departures from, all existing runways. Due to the existing airport layout and the surrounding development there are no plans to extend existing runways or add new runways at McCarran Airport.

b. Complete Visibility of Airport Movement Area: Complete visibility of all airport movement areas cannot be achieved at a viewing height of 294 feet AGL. From this viewing height, Terminal 2 impairs visibility to Taxiway D to the point that only aircraft tails can be seen. Also, visibility to all gates and ramps is not possible at this elevation; however, these areas are controlled by Clark County Aviation Department and there are no plans to turn this function over to FAA.

c. Sufficient Site Area to Accommodate Existing and Future Facilities: The Terminal 3 Site is approximately 2.5 acres and should be large enough to accommodate the ATCT, a small administrative Base Building, employee parking, and ancillary support equipment like an engine generator, a fuel storage tank, and chillers.

d. Compliance with FAR Part 77: A tower constructed at the Terminal 3 Site would not interfere with Part 77 runway approach, primary, or transitional surfaces; however; a tower of a functional height would extend above the Part 77 horizontal surface which would be 2,331 AMSL (150 feet above the Airport Reference Point). To stay below this point a tower at the Terminal 3 Site would not offer acceptable airfield viewing capabilities.

e. Derogation of Existing or Planned Electronic Facilities: A cursory review of existing FAA facilities on and around the airport does not raise any concerns with respect to constructing a new ATCT at the Terminal 3 Site. The systems that were considered included the RTR, VORTAC, ASDE, ASR and RCL. Once a final site is selected, an in-depth analysis will have to be conducted by FAA to ensure that no electronic facilities/equipment will be adversely impacted by the new ATCT.

4.2.4 Terminal 3 Siting Criteria Evaluation – Non-mandatory Requirements

a. Depth Perception to Controlled Surfaces: A tower constructed at the Terminal 3 Site with a viewing height of 294 feet AGL (elevation 2,354 feet AMSL) would provide a minimum vertical angle of 35-minute to all controlled surfaces.

b. Orientation of Tower Cab: The Terminal 3 Site is centrally located between the east-west and north-south runways, but further to the north and east than the existing ATCT. Airfield viewing will range from the north-northwest counterclockwise around to the east-northeast. Airborne traffic patterns will require 360-degree viewing from the tower cab; however, viewing will be minimal to the northeast while all other directions will be prominent.

c. Visibility Impairment by External Light Sources: The hotel/casino lights on the Las Vegas Strip could impact Viewing to the west and northwest. Because of the magnitude of lighting associated with the hotels and casinos, this impact will be common at virtually every site.

   During certain times of the year, reflections from the sun off of the Mandalay Bay hotel/casino will be a concern, especially during the early morning hours when the sun is low in the eastern sky. This impact will likely be common at virtually every site sometime throughout each year.

d. Visibility of All Ground Operation Areas: Visibility of all ground movement areas would not be provided from an ATCT constructed at the Terminal 3 Site. Taxiway D behind Terminal 2 is not visible from a viewing elevation of 294 feet AGL. Also, visibility of some ramp areas will not be achieved; however, viewing of the ramp areas is not an issue because the Clark County Aviation Department maintains control of all ramp areas. There are no plans to give ramp control to the FAA.

e. Visibility Restrictions Due to Local Weather Phenomena: No weather phenomena exist that would particularly affect viewing conditions from a tower at the Terminal 3 Site in comparison to the other potential sites. Research of historical weather data show that fog and/or low ceiling conditions, which could impact taller towers, are basically non-existent at McCarran Airport because of its desert location.

f. Exterior Noise Conditions: An ATCT constructed at the Terminal 3 Site should experience very similar aircraft noise as the current ATCT experiences. The Terminal 3 Site would be located approximately 1,500 feet from the nearest existing Concourse D gates. Eventually, when the remainder of the D Concourse gates are constructed, an ATCT at the Terminal 3 Site would be approximately 1,000 feet away. Due to the distance from ramp/taxiway areas to the ATCT, the noise impact to the ATCT should be minimal.

g. Site Access: Access to the Terminal 3 Site would be via public streets into and on the airport, and on-site employee parking could be provided.

h. Consideration of Planned Airport Expansion: Long-term future development of the airport, including Concourse D expansion, Terminal 3 construction, and the TSA baggage screening building has been considered in this siting study. Ideally, the new ATCT would be commissioned prior to start of construction for Terminal 3 to maximize available space for construction staging and contractor parking.

i. Smoke, Dust and Exhaust Fume Conditions: The likelihood of aircraft or ground vehicle exhaust fumes contaminating the new ATCT ventilation system, or air quality in the facility is very low. The Terminal 3 Site is not on the AOA of the airport, therefore, no special precautions should be required for the HVAC system(s).

Separate from aircraft and vehicle exhaust fumes, industrial smoke, dust and other fumes are not expected to be significant issues at McCarran Airport.

4.2.5 Terminal 3 Siting Criteria Evaluation – Other Considerations

a. Airspace Clearances: An ATCT constructed at the Terminal 3 Site could have an overall structure height of 336 feet (2,396 feet AMSL) without impacting missed approach surfaces or circling minimums.

b. Accessibility of Utility Services: All necessary utilities are available in the area of the Terminal 3 Site and would have to be extended to the ATCT site. These utilities include water, sanitary sewer, storm drainage, electricity, natural gas, and telephone. The FAA fiber optic cable loop ductbank would also have to be extended to the site.

c. Fiber Optic Cable Loop: There is currently a FAA fiber optic cable loop project underway at McCarran Airport that will interconnect all of the FAA facilities on the airport. The cable loop project is currently in the final engineering stages, and construction is scheduled for completion in March of 2005. Current plans show the ductbank will not cross to the east side of Paradise Road anywhere near the Terminal 3 Site. At its closest point, the ductbank will pass within approximately 1,700 feet of the site. The cable loop could be extended to the Terminal 3 Site via open trenching, horizontal directional boring, or a combination of both.

d. Site Security: The proposed Terminal 3 site is about 2.5 acres in size. Security measures would likely require the new ATCT to be protected by a perimeter fence (chain link) and a controlled access entrance gate. The recommended exterior setback (distance to perimeter of FAA site) of 300 feet cannot be met, and the interior setback distance (closest edge of FAA parking lot) of 100 feet will likely not be attained either. The exterior setback distance would require a site of approximately 13 acres, while a site of approximately 4 acres would be needed to meet the interior setback distance. Therefore, the ATCT structure will likely require "hardening measures" due to the increased blast pressures resulting from the reduced setback distances. The extent of those measures will have to be determined by a qualified blast consultant.

   A potential security issue associated with the Terminal 3 Site is a compressed natural gas refueling station that is located on the west side of Kelly Lane. The compressed natural gas is contained in an underground storage tank. During preliminary discussions, the Clark County Aviation Department has indicated that they would be willing to remove this refueling station if FAA expressed a concern over its existence/location.

e. Site Development Costs: The site development costs for the Terminal 3 Site are expected to be "normal". No adverse site conditions are known to exist that would adversely impact the cost, with the exception that the fiber optic cable loop would

likely be more expensive to install due to the distance from the site to the closest access point of the cable loop. Utilities are available in the immediate area and the site is flat and open, allowing for on-site construction staging and parking.

f. Environmental Data: Preliminary Phase I EDDA information shows that the Terminal 3 Site was formerly a housing subdivision and the houses have subsequently been removed. It appears that the site may be have been used to dispose of excess fill dirt. A Phase II EDDA would likely be required to properly delineate the condition of the site. Based on historical information, the Phase II EDDA would cost approximately $10,000 and may take from three to six months to complete.

g. Risk Management: Constructing an ATCT at the Terminal 3 Site would not pose a significant risk to the existing ATCT, TRACON, or other FAA facilities. There would still be a potential risk of interrupting a utility service in the vicinity of the Terminal 3 Site; however, the risk would be localized and relatively low.

h. Airport Tenant Manual: As mentioned previously, the Terminal 3 Site is located on airport property; therefore, the Airport Tenant Manual that is published, maintained, and enforced by the Clark County Aviation Department would apply to an ATCT constructed at this site. Complying with the manual could potentially have a fiscal and/or schedule impact to the project.

4.3 Terminal B Site

4.3.1 Site Description

The Terminal B site is located on the AOA in the area between Terminal 1 and the B Gates. Gates B3, B4, and B8 were recently closed to accommodate the construction the new TSA baggage screening facility in the area. A new ATCT constructed at the Terminal B Site would be centrally located between the runways, and would potentially offer excellent line-of-sight to all runways and taxiways, as well as most ramp areas. Because it is centrally located on the airport, this site would generally minimize the sight distances to the ends of all of the runways.

The characteristics of the Terminal B Site include the following:

- The site is located approximately 2,560 feet north of the centerline of Runway 7L-25R and about 3,040 feet east of the centerline of Runway 1R-19L.

- Distances from Terminal B Site to the runway thresholds are:

01R – 5,935 feet	19L – 5,580 feet
01L – 6,460 feet	19R – 6,140 feet
07L – 6,250 feet	25R – 9,170 feet
07R – 4,730 feet	25L – 8,215 feet

As part of the initial analysis, an Airspace Study (Standard FAA Form 7460-1, *Notice of Proposed Construction or Alteration*) was conducted for the Terminal B Site. The following information was submitted:

Latitude:	36° 05’ 00.43”
Longitude:	115° 09’ 03.75”
Site Elevation:	2,100 feet AMSL
Total Structure Height:	360 feet AGL
Overall Height:	2,460 feet AMSL

The conclusions of the airspace study by the San Francisco Airports Division Office show that there are no objections to an ATCT structure of the submitted height at the proposed location; however, several Clark County Aviation Department offices were concerned about the location of the control tower with respect to the TSA baggage screening facility planned in the vicinity.

Since the Terminal B Site is dislocated from the existing Base Building/TRACON, it would require the construction of a base building adjacent to the new ATCT for administrative and ancillary functions. Based on preliminary input from Air Traffic and Airway Facilities, and ATO, the estimated space allocations below could be expected for LAS ATCT:

Administrative Space	6,000 SF
Ancillary Support Space (Electrical, Mechanical)	1,500 SF
Total Base Building Size	7,500 SF

This is an estimated figure for cost comparison purposes only. If the Terminal B Site is selected, an in-depth space calculation, in accordance with the ATO/ATB-300 Facility Space Standard, will be required to determine final allowable size for the Base Building.

4.3.2 Terminal B Tower Height Requirement

The minimum tower viewing height needed to provide a 35-minute viewing angle to all airfield surfaces was calculated to be approximately 117 feet above ground level. The corresponding elevation would be 2,217 feet AMSL. The total ATCT height would be approximately 147 feet above ground level, assuming a 30-foot height of tower cab roof structure, antennas, air terminals, or other appurtenances above the viewing height (35 feet above the cab floor height). The top of the tallest tower appurtenances to accommodate the minimum tower viewing height would be at 2,247 feet AMSL.

Since the Project Team did not want to waste time and effort entertaining tower heights that were unreasonably tall, a preliminary TERPS analysis was completed for the Terminal B Site to establish the maximum allowable tower height. Based on that analysis, the maximum allowable tower height (to the tallest appurtenances) was calculated to be 360 feet above ground level (2,460 feet AMSL).

Based on the AFTIL model/simulation, the tower viewing height needed to provide full visibility to all runways and taxiways was determined to be 254 feet above ground level. The corresponding elevation would be 2,354 feet AMSL. The total ATCT height would be approximately 284 feet above ground level, assuming a 30-foot height of tower cab roof structure, antennas, air terminals, and other appurtenances above the viewing height (35 feet above the cab floor height). The top of the tallest tower appurtenances would be 2,384 feet AMSL, which is 76 feet below the maximum allowable tower elevation of 2,460 feet AMSL at this location.

4.3.3 Terminal B Siting Criteria Evaluation – Mandatory Requirements

a. Maximum Visibility of Airborne Traffic Patterns: An ATCT constructed at the Terminal B Site would provide full visibility of all airborne traffic patterns, including aircraft approaches to, and departures from, all existing runways. Due to the existing airport layout and the surrounding development there are no plans to extend existing runways or add new runways at McCarran Airport.

b. Complete Visibility of Airport Movement Area: Complete visibility of all airport movement areas cannot be achieved at a viewing height of 200 feet AGL (2,300 feet AMSL). The existing ATCT would potentially block visibility to the threshold/touchdown area of Runway 25R. All other movement areas are visible at

200 feet AGL.

Complete visibility of all airport movement areas can be achieved at a viewing height of 254 feet AGL (2,354 feet AMSL). At this elevation, the threshold of Runway 25R is visible by viewing over the top of the existing ATCT structure. Visibility to all gates and ramps is not possible at this elevation; however, these areas are controlled by Clark County Aviation Department and there are no plans to turn this function over to FAA.

c. Sufficient Site Area to Accommodate Existing and Future Facilities: The Terminal B Site should be large enough to accommodate the ATCT, a small administrative Base Building, and ancillary support equipment like an engine generator, a fuel storage tank, and chillers for the HVAC system. Coordination with the Clark County Aviation Department would be required to determine the impacts to, and from, the TSA baggage inspection facility that is planned in the B Gate area.

d. Compliance with FAR Part 77: A tower constructed at the Terminal B Site would not interfere with Part 77 runway approach, primary, or transitional surfaces; however; a tower of a functional height would extend above the Part 77 horizontal surface which would be 2,331 AMSL (150 feet above the Airport Reference Point). To stay below this point a tower at the Terminal B Site would not offer acceptable airfield viewing capabilities.

e. Derogation of Existing or Planned Electronic Facilities: A cursory review of existing FAA facilities on and around the airport does not raise any concerns with respect to constructing a new ATCT at the Terminal B Site. The systems that were considered included the RTR, VORTAC, ASDE, ASR and RCL. Once a final site is selected, an in-depth analysis will have to be conducted by FAA to ensure that no electronic facilities/equipment will be adversely impacted by the new ATCT.

4.3.4 Terminal B Siting Criteria Evaluation – Non-mandatory Requirements

a. Depth Perception to Controlled Surfaces: A tower constructed at the Terminal B Site with a viewing height of 254 feet AGL (elevation 2,354 feet AMSL) would provide a minimum vertical angle of 35-minute to all controlled surfaces.

b. Orientation of Tower Cab: The Terminal B Site is centrally located between the east-west and north-south runways, and approximately 2,500 feet northeast of the existing ATCT. Airfield viewing will range from the north-northeast counterclockwise around to the east-southeast. Airborne traffic patterns will require 360-degree viewing from the tower cab; however, viewing will be minimal to the northeast while all other directions will be prominent.

c. Visibility Impairment by External Light Sources: Viewing to the west and northwest could be impacted by the hotel/casino lights on the Las Vegas Strip. Because of the magnitude of lighting associated with the hotels and casinos, this impact will be

common at virtually every site.

During certain times of the year, reflections from the sun off of the Mandalay Bay hotel/casino will be a concern, especially during the early morning hours when the sun is low in the eastern sky. Again, this impact will be common at virtually every site sometime throughout each year.

d. Visibility of All Ground Operation Areas: Visibility of all ground movement areas would be provided from an ATCT that is constructed at least 254 feet AGL (2,354 feet AMSL) at the Terminal B Site. At an elevation of 200 feet AGL, the existing ATCT would potentially block visibility to the threshold of Runway 25R, and would remain an impact as long as the old ATCT was left standing. Visibility of some ramp areas cannot be achieved at this elevation, especially in the B Gate area as aircraft approach the base of the ATCT (look-down); however, as mentioned earlier, viewing of the ramp areas is not an issue because these areas are controlled by Clark County Aviation Department and there are no plans to turn this function over to FAA.

e. Visibility Restrictions Due to Local Weather Phenomena: No weather phenomena exist that would particularly affect viewing conditions from a tower at the Terminal B Site in comparison to the other potential sites. Research of historical weather data show that fog and/or low ceiling conditions, which could impact taller towers, are basically non-existent at McCarran Airport because of its desert location.

f. Exterior Noise Conditions: Since the Terminal B Site is located on the AOA near the B Gates, it is expected that the noise level would be higher than at the existing ATCT. Special analysis would likely be necessary during engineering to determine the noise impacts of the facility, especially the Base Building. The study would need to include recommendations for mitigating the impacts.

g. Site Access: Access to the Terminal B Site would be more difficult than any of the other three sites. Since the Terminal B Site is directly on the AOA, FAA employee access, contractor access, and vehicle parking are all areas that will be impacted due to the security restrictions associated with placing a facility on the airfield. FAA employees working at the facility would have to park in the airport parking structure and walk to the ATCT through Terminal 1. Any contractors performing work at the ATCT after commissioning would have to be badged to be in the FAA facility as well as on the AOA. The drivers of Government Owned Vehicles (GOV), and mail/delivery trucks that require frequent access to the facility would have to be trained to drive on the AOA and/or escorted to and from the site.

h. Consideration of Planned Airport Expansion: Long-term future development of the airport, including Concourse D expansion, Terminal 3 construction, and the TSA baggage screening facility has been considered in this siting study.

i. Smoke, Dust and Exhaust Fume Conditions: Since the Terminal B site is located directly on the AOA, the likelihood of aircraft or ground vehicle exhaust fumes

contaminating the new ATCT ventilation system, or air quality in the facility is moderate to high. Although three of the B Gates have been closed in the vicinity of the Terminal B Site, the exhaust fume impacts from ground vehicles and/or aircraft would be dependant upon vehicle movement patterns. HVAC system fresh air intakes could be strategically located to minimize the risk; however, special air filtration systems would likely be required to remove impurities.

Separate from aircraft and vehicle exhaust fumes, industrial smoke, dust and other fumes are not expected to be significant issues at McCarran Airport.

4.3.5 Terminal B Siting Criteria Evaluation – Other Considerations

a. Airspace Clearances: An ATCT constructed at the Terminal B Site could have an overall structure height of 360 feet AGL (2,460 feet AMSL) without impacting missed approach surfaces or circling minimums.

b. Accessibility of Utility Services: All necessary utilities are available in the area of the Terminal B Site and would have to be extended to the ATCT site. These utilities include water, sanitary sewer, storm drainage, electricity, natural gas, and telephone. The FAA fiber optic cable loop ductbank would also have to be extended to the site. All of the utility services would have to be installed under existing airport ramp pavement open trenching, horizontal directional boring, or a combination of both. The presence of underground jet fuel lines around the B Gates could potentially impact the installation of the utilities.

c. Fiber Optic Cable Loop: There is currently a FAA fiber optic cable loop project underway at McCarran Airport that will interconnect all of the FAA facilities on the airport. The cable loop project is currently in the final engineering stages and actual construction is scheduled for completion in March of 2005. Current plans show the ductbank will pass within approximately 800 feet of the Terminal B site. The fiber optic ductbank would have to be installed under existing airport ramp pavement. This would likely be accomplished by horizontal directional boring. The presence of underground jet fuel lines around the B Gates could potentially impact the installation of the fiber optic cable loop.

d. Site Security: The proposed Terminal B Site is on the AOA of McCarran Airport and would offer some degree of site security merely by its location. Although vehicle and perimeter setbacks would be difficult to attain due to aircraft and ground vehicle movement in the immediate area, the restricted access to the AOA should prevent unauthorized vehicles from getting too close to the ATCT in the first place.

   The construction of a new TSA baggage inspection facility is planned in the B Gate area in close proximity to the proposed Terminal B Site. Due to the inherent function of this facility, there is an increased risk to the ATCT structure. Depending upon the magnitude of an event, if one was to occur at the baggage inspection facility, there would potentially be a direct impact to the ATCT and possibly its

occupants.

The ATCT personnel could also be directly impacted at the Terminal B Site if a security breach occurred in Terminal 1. If a security breach occurred, no passengers would be allowed in or out of the Terminal. Airport security personnel would then determine whether or not the Terminal needed to be 'dumped', which would require all passengers to exit past security and be re-screened. If a 'dump' were necessary, it could take quite awhile to move the potential several thousand passengers out of the terminal, and get them all back in. If the breach occurred at an ATCT shift change, the relieving shift may be delayed in the terminal.

Underground jet fuel lines in and around the Terminal B area could pose a direct security threat to an ATCT constructed at the Terminal B Site; however, the size and location of each line would have to be considered. Any fuel lines that fell within the footprint of either the ATCT or Base Building would have to be relocated, and others that were determined to be too close could be moved as well.

e. Site Development Costs: The expected site development costs for the Terminal B Site would likely be higher than the Terminal 3 Site. The restricted AOA access for construction vehicles and employees, along with the concrete ramp pavement, create additional burdens on the contractor that do not occur on any of the other three sites. Also, there are underground fuel lines around the gates that will have to be protected/removed/relocated during construction activities.

f. Environmental Data: Preliminary Phase I EDDA information shows that the Terminal B Site has underground jet fuel lines in the immediate area. A Phase II EDDA would likely be necessary to determine if any fuel has leaked into the soil and, if so, the extent of contamination. Based on historical information, the Phase II EDDA would cost approximately $10,000 and may take from three to six months to complete.

g. Risk Management: Constructing an ATCT at the Terminal B Site would not pose a significant risk to the existing ATCT and TRACON facilities. There would still be a potential risk of interrupting a utility service and/or underground fuel line in the vicinity of the Terminal B Site; however, the risk would be localized and relatively low. Also, a catastrophic construction accident could impact the B Gates, Terminal 1, and/or the TSA baggage inspection facility; however, the risk of such an accident would be low.

h. Airport Tenant Manual: As mentioned previously, the Terminal B Site is located on airport property; therefore, the Airport Tenant Manual that is published, maintained, and enforced by the Clark County Aviation Department would apply to an ATCT constructed at this site. Complying with the manual could potentially have a fiscal and/or schedule impact to the project.

i. Clark County Aviation Department Review: The location of all three potential siting

options was routed through the various offices of the Clark County Aviation Department for review and comments. While Site C and the Terminal 3 Site did not receive any comments, the comments received for the Terminal B Site were predominantly negative. The concerns over an ATCT located at the Terminal B Site included the following: 1) the site will conflict with in-line baggage; 2) the location could restrict future airport growth; 3) the site would have security implications; and 4) a tower constructed near the B gates would block the view of west ramp control.

5. COMPARISON OF PRIMARY SITING OPTIONS

5.1 Summary of Advantages and Disadvantages of Primary Siting Options

A summary of the relative advantages and disadvantages of each of the primary siting options is provided below.

Site C

Advantages:

- No Base Building would be required. The existing Base Building would be utilized for administrative and operational (TRACON) functions.
- Could have an overall tower height of 330 feet AGL without impacting missed approach surfaces or circling minimums.
- A viewing height of 265 feet AGL provides adequate viewing of all airfield movement areas.
- Extension of utilities to the new ATCT would be relatively easy, and cheaper than any other site. Even the fiber optic cable loop could be easily extended to the new ATCT because it will already be tied into the existing facility.
- A Phase II EDDA would not be required.
- Minimizes average distance to all runway thresholds.
- On-site employee parking would be available after the construction activities conclude.

Disadvantages:

- The site is extremely confined and would likely increase construction costs by as much as 30% due to lack of construction staging space.
- FAA employee parking would be severely impacted. Approximately 80 of the existing 116 parking spaces would be displaced during the construction phase of the project. Displacing the FAA parking would be necessary to provide the contractor with minimal construction staging area and maneuverability.
- Risk to FAA or airport property/facilities due to construction activity is low; however, an accident could impact the existing ATCT/TRACON, the elevated passenger tram, and/or main airport egress roads.
- The ATCT would be located within 50 feet of Wright Brothers Lane, which would require extensive blast hardening of the ATCT shaft. Also, the interior security setback of 100 feet for parking would not be possible. Cost impacts due to structural hardening are expected to be as much as 20%.
- The seismic requirements and soil conditions for Las Vegas would warrant steel-framed construction for elasticity and flexibility of the ATCT structure; however, the blast requirements warrant thick, heavy concrete walls that can resist blast over-pressures. This would create a very rigid structure, which would be in direct conflict with the seismic requirements. Base on the opinion of engineering professionals, it does not appear that both sets of criteria (seismic and security) can be met at Site C.

- The elevated passenger tram and underground baggage tunnel to the east of the site would have to be structurally protected due to the overhead crane work/operations, which directly impacts construction costs.
- Special provisions/concessions from the Clark County Aviation Department would likely be necessary for adequate semi-tractor trailer ingress/egress and tower crane location.
- With the AOA to the south, the baggage tunnel and GSE building to the east, and Wright Brothers Lane to the north, future expansion of the ATCT or Base Building would not likely be possible.
- A "link" would likely have to be constructed between the ATCT shaft and the existing Base Building for personnel movement and cable routing. The link would have to be approximately 90 feet long.
- Site C is located on airport property; therefore, the Airport Tenant Manual would be enforced by the Clark County Aviation Department.

Terminal 3 Site

Advantages:

- Minimizes average distance to most runway thresholds.
- Could have an overall tower height of 336 feet AGL without impacting missed approach surfaces or circling minimums.
- A viewing height of 294 feet AGL provides adequate viewing of all airfield movement areas.
- No derogation of existing FAA electronics facilities.
- No direct impact to existing ATCT/TRACON during construction. The new ATCT and/or crane would not block any portions of any runway or taxiway when viewing from the existing ATCT.
- On-site employee parking would be available.
- Site is large enough for contractor parking and staging during construction. Also, site access does not require utilization of the main ingress and egress roads for McCarran Airport.
- Site is large enough to accommodate future expansion of Base Building.
- Full interior security setback (100 feet) could not be attained; however, vehicles would be further away from the facility than either of the other two potential sites.
- Risk to FAA or airport property/facilities due to construction activity is very low.

Disadvantages:

- This site has the lowest ground elevation of all the potential sites (2,060 AMSL), which would require a taller structure to achieve the minimum viewing height.
- This site requires the tallest ATCT structure to achieve the minimum viewing elevation.
- Site would require a Base Building for administrative and ancillary support functions.

- Phase II EDDA would likely be required to assess soil conditions based on historical use of property. Historical records indicate that the Terminal 3 Site was once a residential area and the homes were demolished. Fill material (soil) was hauled in to bring the surrounding area up to finished grade. The source of the soil is unknown and should be investigated for potential contaminants.
- Extension of the fiber optic cable loop would likely be the most difficult when compared to the other sites due to the distance to the nearest manhole and the potential obstacles along the path (streets, underground water reservoir, compressed natural gas filling station).
- Site is located on airport property; therefore, the Airport Tenant Manual would be enforced by the Clark County Aviation Department.

Terminal B Site

Advantages:

- Achieves a 35-minute viewing angle at the lowest tower height; a taller tower would provide greater depth perception of the airfield than any of the other sites.
- Site B has the highest existing ground elevation of the centrally located sites (2,100 AMSL), which could reduce the overall structure height.
- Could have an overall tower height of 360 feet AGL without impacting missed approach surfaces or circling minimums.
- A viewing height of 250 feet AGL provides adequate viewing of all airfield movement areas.
- No direct impact to existing ATCT/TRACON during construction. The new ATCT and/or crane would, however, block portions of Taxiway D and the north-south runways when viewing from the existing ATCT.
- Minimizes average distance to all runway thresholds.
- No derogation of existing FAA electronics facilities.
- Site is located on the AOA and would likely provide a greater degree of security due to restricted access.
- Excellent viewing of all runways and taxiways, especially at Terminal 2.

Disadvantages:

- Site would require a Base Building for administrative and ancillary support functions.
- Construction would be hampered by airport restrictions for operating on the AOA.
- No employee parking would be available at the base of the ATCT. FAA personnel would park in the airport parking structure and access the ATCT via Terminal 1.
- Security breaches in Terminal 1 have the potential to impact ATCT shift changes.
- After commissioning of the ATCT, access by delivery vehicles (vending, mail, UPS, etc) and contractors would be more difficult than any of the other sites.

- Potential to draw aircraft and/or ground vehicle exhaust fumes into HVAC system. Air filtration would likely be required on all intake systems.
- Potential aircraft noise concerns due to proximity to taxiing aircraft.
- ATCT and Base Building would be located near the new TSA baggage screening facility, which has inherent security concerns of its own.
- Neither interior nor exterior security setback distances could be attained; however, AOA inherently provides some level of security.
- Phase II EDDA would be required to assess possible underground fuel contamination.
- Extension of utility services would likely be the most expensive when compared to the other sites due to ramp pavement, underground fuel lines around the B Gates, and restricted AOA access.
- Site is located on airport property; therefore, the Airport Tenant Manual would be enforced by the Clark County Aviation Department.
- Site received predominantly negative comments from the various Clark County Aviation Department offices that reviewed all of the potential sites.

5.2 Summary Comparison of Primary Siting Options

Table 4 presents a summary comparison of the three primary siting options. Comparisons are indicated for a variety of factors related to the viewing capability of a tower at each site, as well as other relevant considerations such as site access, exposure of the tower facility to noise and aircraft exhaust fumes, and the ability of each site to accommodate the ATCT facility. Background information and explanations of specific factors included in the table are as follows:

- Minimum height for 35-minute angle: The minimum height for a tower was calculated based on the viewing height needed to provide the minimum 35-minute vertical viewing angle to all airport surfaces. Calculations were made for all existing surfaces.

- Maximum allowable total height: The maximum allowable total structure height was determined considering existing and proposed instrument approach and missed approach surfaces. It was assumed that a future tower should generally not affect approach minimums, and thus should be below approach and missed approach surfaces.

- Greatest distance to runway thresholds: The distances from each tower site to all runway thresholds were determined. The greatest distance to runway thresholds is indicated in the table for each tower site.

- Line of sight – airborne and airfield surfaces: The table indicates the line of sight obstructions that would exist from the proposed tower viewing height at each of the sites. “Airborne” refers to the approaches to all runways; “airfield surfaces” refers to the operational surfaces of the airport.

- Site access and parking: The table indicates for each site whether tower personnel would be able to drive directly to the tower site, and whether the site could accommodate on-site parking of personnel.

- Site area available: The area available for an ATCT facility at each site was qualitatively evaluated in terms of constraints on the site. The constraints on the sites vary between the sites, with the existing site (Site C) having the greatest constraints.

- Possibility of future expansion: A preliminary, qualitative assessment of whether or a particular site would provide adequate space to accommodate expansion of the Base Building at a future date.

- Ability to provide secure site: Security provisions meeting FAA requirements will be provided for the new ATCT facility at any site. Whether security is provided by the physical separation standards of FAA Order 1600.69 or by other means will be dependent upon the site. It is generally assumed that a site located within the AOA would offer greater security than a site that is not on the AOA. A site on an aircraft parking apron could not likely provide physical separations, due to the impact on aircraft parking that would result from the separation distances. It has been assumed that this would be acceptable to the FAA.

- Environmental considerations: A preliminary, qualitative assessment of environmental considerations for each site was made on the basis of available, preliminary information. A detailed environmental assessment of the selected tower site will be conducted in a separate effort.

- Impact on adjacent land uses: The table indicates a general, qualitative assessment of the impacts of a tower facility on adjacent land uses at each of the sites.

- Effect on FAA electronics facilities: A general assessment was made of the potential impacts of a tower at each site on transmitter/receiver facilities, navigational aids, radar facilities, and radio communication links. The assessment was made on the basis of the location of each potential tower site in relation to the locations of electronics facilities. Any large structure on the airport would be expected to have some effect on electronic navigation and surveillance facilities. For the purposes of this comparison of the sites, it was assumed that electronic facilities or operational procedures could compensate for, or be adjusted, to accommodate any minor effects. A detailed evaluation of the final site(s) will need to be conducted by the FAA.

- Availability of utilities: The availability of utility services at the location of each site was evaluated qualitatively on the basis of existing development in the vicinity of each site and the general proximity of the airfield and airfield lighting,

communications, and surveillance systems.

- Access to fiber optic cable loop: The ability to extend the fiber optic cable loop to each of the sites was assessed on the basis of proximity to the proposed route and

- Risk Management: Potential of construction contractor's activities and/or a construction accident to disrupt service/operations of FAA/airport facilities.

	Primary Siting Options		
	Site C	**TERMINAL B**	**TERMINAL 3**
Location	Centrally located on airport. Northeast corner of existing ATCT/TRACON parking lot.	Centrally located on airport. Near B Gates of Main Terminal. On the AOA.	Centrally located on airport. Near intersection of Kelly Lane and existing Russell Road. Near Future Terminal 3.
Minimum Height 35 min. viewing angle (AGL)	125 feet	117 feet	162 feet
Maximum Allowable Height (AGL)	321 feet	360 feet	over 900 feet up to the circling minimum of 3,020 AMSL
Proposed Cab Floor Height (AGL)	254 feet	250 feet	294 feet
Line of Sight - Airborne	No obstructions	No obstructions	No obstructions
Line of Sight - Airfield Surfaces	No obsrtuctions to runways or taxiways. Some ramp/gate areas not visible	No obsrtuctions to runways or taxiways. Some ramp/gate areas not visible	No obsrtuctions to runways. Minimal blockage of visiblity to Taxiway D behind Teminal 2. Some ramp/gate areas not visible
Airspace Impacts	None	None	None
Cab Orientation	All directions except to the northeast	All directions except to the northeast	All directions except to the northeast
Greatest Distance to Runway Threshold	7,965 feet to Runway 25R	9,170 feet to Runway 25R	9,640 feet to Runway 01L
Site Access and Parking	Direct access and on-site parking after new ATCT constructed. Displaces 80 parking spaces during construction	Personnel access via Main Terminal. No on-site parking	Direct access and on-site parking
Noise/Exhaust Exposure	Low exposure long-term. High exposure during construction	High exposure	Low exposure near-term. Low exposure long-term
Environmental Considerations	No specific issues. No Phase II EDDA required	Underground fuel liines. Phase II EDDA likely required.	Soil concern. Phase II EDDA likely required.
Site Area Available	Highly encumbered site - elevated passenger tram, baggage tunnel, public street. No staging area for construction materials. FAA parking impacted	Somewhat unencumbered site. Located on AOA	Unencumbered site - no restrictions

Table 4 – Summary Comparison of Primary Siting Options

	Primary Siting Options		
	Site C	**TERMINAL B**	**TERMINAL 3**
Security Considerations	No interior setback. No exterior setback. ATCT structure hardened for Wright Bros Lane and passenger tram	No interior setbacks. No exterior setbacks. ATCT in secured AOA area	Some interior setback. No exterior setback. ATCT structure and Base Building require hardening.
Possibility of Future Expansion	None	Expansion possible - dependant upon TSA facility	Expansion possible
Impact on Adjacent Land Use	None	None	None
Effect on FAA Electronics Facilities	None	None	None
Availability of Utilities	Available	Available	Available
Access to Fiber Optic Cable Loop	Easy access - cable loop will already encompass existing ATCT/TRACON	Access available - cable loop will pass within 800 feet of site - ramp pavement and fuel lines may cause difficulties	Access available - cable loop will pass within 1,700 feet of site - water reservoir and compressed natural gas station may cause difficulties
Risk Management	Potential to disrupt operations of existing ATCT/TRACON by disturbing existing utilty line(s). Also, proximity of passenger tram is a major concern; baggage tunnel to the east is a minor concern	Very low risk to existing ATCT/TRACON. Risk to utilities is low and localized, although Terminal 1 or TSA building could be impacted. Risk to underground fuel lines is moderate.	Very low risk to existing ATCT/TRACON. Risk to utilities is low and localized.

Table 4 – Summary Comparison of Primary Siting Options (Continued)

5.3 Summary Cost Comparison of Primary Siting Options

Table 5 presents a summary cost comparison of the three primary siting options. Although the intent of the siting effort was to locate a suitable ATCT site, some very preliminary design and construction estimating was determined to be necessary to fully compare the validity of each potential site. The FAA budget justification states that a new ATCT shall be constructed on the existing site, thereby utilizing the existing Base Building for administration, operational, and ancillary support; however, the space available on the existing site for a new ATCT is very limited and will result in construction cost premiums. Constructing an ATCT on the AOA (Terminal B) site is expected to add a cost premium due to the badging requirements for the construction contractor, driving/escorting vehicles on the AOA, and potentially limited construction staging.

If either the Terminal B or Terminal 3 site is selected as the final site, there are associated project costs that would not be required at Site C. Most notably, both of these sites would require the construction of a Base Building for administrative and ancillary support functions. To make a fully informed decision about the most suitable site for a new ATCT at McCarran Airport, the Project Team felt that relative construction costs should be considered as one of the determining factors.

- Cost of ATCT: The table indicates the expected ATCT height based on cab floor elevation, an estimated cost per vertical foot, and total estimated cost of the ATCT. The expected ATCT height was based on the ability to achieve complete visibility of airport movement areas. The estimated cost per vertical foot was averaged for several recent, larger ATCT projects around the country.

- Base Building: Necessity of constructing a Base Building adjacent to new ATCT to accommodate administrative and ancillary support functions.

- Cost of an adjacent Base Building: Where required, the table indicates the estimated total square footage, approximate cost per square foot, and total estimated cost of constructing a Base Building adjacent to the ATCT.

- Cost premiums: The cost premium associated with a particular site was determined by general industry standards, construction experience, and input from Jacobs Engineering (national FAA contractor). The cost premiums include site constraints/restrictions for an encumbered site, security requirements, and blast considerations.

The basic intent of Table 5 is to compare the relative costs of constructing a facility on any one of the three primary sites, not determine the actual construction costs at this early stage of the project. Although the budget justification states that a new ATCT shaft should be constructed on the existing ATCT/TRACON site, the premiums associated with that site drive the overall construction costs much higher. An ATCT constructed at the Terminal 3 site would require a taller shaft to achieve an acceptable

viewing height. Construction activities at the Terminal B Site would be complicated by its location on the AOA. When comparing the three options, including all of the additional costs and premiums, the construction costs for the Terminal B and Terminal 3 Sites are relatively the same. Even though these two sites would require the construction of a Base Building, their estimated costs are lower than the Terminal C Site.

	Primary Siting Options		
	Site C	**TERMINAL B**	**TERMINAL 3**
Proposed cab floor elevation (ft AGL)	260	250	289
Base Cost of ATCT ($50,000/vert. ft)	$13,000,000	$12,500,000	$14,450,000
Base Building Required	No	Yes	Yes
Estimated size of Base Building (SF)	N/A	7,500	7,500
Base Cost of Base Building ($250/square ft)	$0	$1,875,000	$1,875,000
Subtotal of Estimated Building Costs	$13,000,000	$14,375,000	$16,325,000
Premium for encumbered site	30%	15%	N/A
	$3,900,000	$2,156,000	$0
Premiums for security (harden structure due to lack of setbacks)	No interior setback. No exterior setback. Elevated tram. - 20 %	No interior setback. No exterior setback. On AOA. - 10%	Some interior setback. No exterior setback. - 10%
	$2,600,000	$1,438,000	$1,632,500
Total Estimated Cost	$19,500,000	$17,969,000	$17,958,000

Table 5 – Summary Cost Comparison of Primary Siting Options

5.4 Summary Comparison of Life Cycle Costs

An important factor that must be considered during the site selection process is the long-term operations and maintenance, or life cycle, costs for each of the siting options. For the LAS ATCT project, three options must be considered to reasonably determine the impacts to the life cycle costs. The first option would be to construct a new ATCT at Site C and utilize the existing Base Building. The second option would be to construct a new ATCT and small Base Building on either the Terminal B or Terminal 3 Site and utilize the existing Base Building for the TRACON functions. The third option would be to construct a new ATCT and Base Building on the Terminal B or Terminal 3 site large enough to accommodate the TRACON functions so the entire facility could be relocated. For this report, the life cycle costs of the ATCT have been ignored because the shaft and cab would be approximately the same size at any of the potential siting options; therefore, the cost would be the same for any of the three sites.

5.4.1 ATCT Constructed at Site C

A new ATCT constructed at Site C would utilize the existing Base Building and the overall life cycle costs for the facility would be expected to remain relatively the same. The existing Base Building measures approximately 20,000 square feet. At $12 per square foot per year (standard life cycle cost used by ATO - broken down as $3 per SF per year for building maintenance, repair and replacement, $6 per SF per year for utilities, and $3 per SF per year for janitorial costs), the expected yearly life cycle costs for the existing Base Building would be $168,000.

5.4.2 ATCT with 7,500 SF Base Building at the Terminal B or Terminal 3 Site

The Terminal B and Terminal 3 Sites would each require the construction of a new Base Building for administrative and ancillary functions. This new space would be in addition to the existing Base Building that would have to remain operational for the TRACON functions. A 7,500 square foot Base Building would have estimated life cycle costs of approximately $90,000 per year (7,500 SF x $12/SF). This $90,000 of life cycle costs would be in addition to the $168,00 that would be required to maintain the existing Base Building. The total for both facilities would be about $258,000 per year.

5.4.3 ATCT with 20,000 SF Base Building at the Terminal B or Terminal 3 Site

The last option that should be considered would be one in which both the ATCT and TRACON functions were moved to either the Terminal B or the Terminal 3 Site. If both functions were relocated, and the new Base Building was kept at 20,000 square feet, the life cycle costs would be expected to remain the same as the existing facility, which would be approximately $168,000 per year.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

6.1.1 Terminal B Site

A review of the three primary siting options (Site C, Terminal B, and Terminal 3), by FAA and the Clark County Aviation Department, and consideration of the advantages and disadvantages of each potential siting option, led to the determination that the Terminal B Site should be eliminated from further consideration. Although an ATCT constructed at this site would offer excellent line-of-sight viewing to all airfield movement areas and airborne traffic patterns, the disadvantages associated with this site far outweigh the advantages. In the end, the proximity to the new TSA baggage screening facility, restricted AOA access, lack of personnel parking at the ATCT, the proximity of underground fuel lines, dissatisfaction with the site by the Clark County Aviation Department offices, and the probable exposure of the facility to aircraft noise and exhaust fumes were all prominent factors for eliminating the site.

6.1.2 Site C

Due to the restrictions associated with Site C, Jacobs Engineering, Inc., as part of a national A/E contract, performed a construction feasibility study for the site. The combination of Wright Brothers Lane along the north, the baggage tunnel just to the east, and the elevated passenger tram along the west and south of the site creates and encumbered site that does not allow adequate space for crane operations, materials staging, and contractor parking. When all of these factors are combined, the cost of construction is driven as much as 30% higher than an open sight with adequate space to spread out construction activities.

The Jacobs report, which is included in Appendix 3, also states that there is a major design conflict between the seismic (earthquake) and FAA blast requirements associate with Site C. Due to the close proximity of Wright Brothers Lane, which is a public street and would be less than 50 feet from the ATCT, the recommended exterior setback of 300 feet cannot be met. As a result, the ATCT shaft would have to be hardened against a potential blast event at Wright Brothers Lane. Experience shows that structural hardening would require the walls of the ATCT shaft to be thickened from around 12 inches to at least 30 inches. The structural modifications would create a very rigid, heavy building, and is in direct conflict with seismic design requirements. The expected ground accelerations and soil types for Las Vegas dictate that a steel-framed structure would be required because it would provide a lighter, more elastic (flexible) building, which are desirable features when contending with seismic loads.

To mitigate the potential conflict of design requirements, the Project Team investigated a few alternatives. The first was to determine whether or not the blast criteria could be relaxed. As expected, Security informed the Project Team that the only alternative to meeting the setback distances was to mitigate the threat by hardening the structure;

therefore, we investigated the option of increasing the setback distance. The only feasible method of attaining this goal would have been to close Wright Brothers Lane to through-traffic, move the FAA perimeter fence to the north side of the street, and install an FAA gate/card reader on Wright Brothers Lane as far to the east as possible. The Clark County Aviation Department reviewed the proposal; however, they could not approve it because of the airport tenants and activities to the west of the FAA site.

Other disadvantages associated with constructing an ATCT at Site C are the negative impact to FAA parking, higher risk to FAA and airport facilities/operations, increased construction costs to protect existing entities, and the lack of future expansion capability. Because of the magnitude of the disadvantages of utilizing Site C, especially the inability to design an ATCT structure capable of complying with both the seismic design requirements and the FAA blast criteria, it was determined that this site should be dropped from consideration as well.

6.2 Recommendations

6.2.1 Terminal 3 Site - Initial Conclusions

Based on the analysis and evaluation of this siting study, including the TERPS results, the AFTIL model/simulator, airspace studies, and a thorough review of the advantages and disadvantages of constructing a facility at the site, it was determined that relocating the LAS ATCT to the Terminal 3 Site would be the best alternative. The Terminal 3 Site would offer excellent line-of-sight viewing of all airborne traffic patterns and runways, as well as very good line-of-sight viewing of all ground movement areas. Although this site would require a taller ATCT shaft and a small Base Building for administrative and ancillary support functions, the relative construction costs would be less than constructing an ATCT shaft only at Site C.

Constructing a new ATCT and Base Building at the Terminal 3 Site would increase the overall operations and maintenance (O & M) costs of the LAS ATCT and TRACON facilities by approximately $90,000 per year, assuming a 7,500 square foot Base Building was constructed to support the new ATCT. The $90,000 impact would be in addition to the estimated $240,000 in O & M costs currently needed to operate the existing 20,000 square foot Base Building.

Accordingly, the initial conclusion of this siting study was that the new ATCT should be located at the Terminal 3 Site near the intersection of Russell Road and Kelly Lane. It was recommended that the ATCT be constructed with a cab floor elevation of 289 feet AGL (2,349 feet AMSL), which corresponds to a viewing height of 294 feet AGL (2,354 feet AMSL) and an overall height of 324 feet AGL (2,384 feet AMSL).

6.2.2 Mid-summer 2004 Developments, Impacts and Conclusions

In July of 2004 after the Siting Report was submitted for a 95% review by the Project Team, the FAA was informed of some late-developing changes to the Terminal 3

building plans by the Clark County Department of Aviation. They explained that the Terminal 3 building footprint was enlarged and that it had to be shifted further to the west. As a result of these changes, the size of the (primary) FAA site on the east side of Kelly Lane would have to be severely reduced, thus directly impacting the exterior setback distances, and limiting the future expansion capabilities of the site.

At the same time, the Clark County Department of Aviation informed the FAA that the Terminal 3 Site located on the west side of Kelly Lane could be increased from the initial 1.5 acres to about 3.5 acres, see Figure 4. Whereas the original 1.5 acres was not adequate, the revised plot size on the west side of Kelly Lane would accommodate increased setback distances as well as future expansion. In addition, the Aviation Department advised FAA that Kelly Lane would be removed as part of the Terminal 3 building construction so the west Terminal 3 Site would abut the AOA on the east and south sides of the property. Because the AOA is inherently a secure area, the new ATCT and Base Building could be constructed on the southern portion of the site, thus moving it further away from public streets, and thereby further improving setback distances.

After the FAA was informed of the Terminal 3 building changes, it was decided by the Project Team that a trip back to the AFTIL would be necessary to confirm viewing heights and determine the best location for the ATCT within the revised property boundaries of the west Kelly Lane site. Air Traffic (AWP-510, LAS AT, and LAS NATCA) and ANI-540 traveled to Atlantic City during the week of July 26, 2004 to assess the impacts of moving the Terminal 3 Site. It was determined that by moving the ATCT site to the west side of Kelly Lane, the line of sight was improved to Taxiway D behind Terminal 2 and the visibility impact of the existing ATCT from the new cab was reduced. The AFTIL model/simulator clearly showed that the further west that the new ATCT was moved, the better overall visibility improved.

Based on the information obtained from the Clark County Department of Aviation in July of 2004, and the results of the AFTIL model/simulator visit, the recommendation was revised, thus moving the Terminal 3 Site from the east side of Kelly Lane to the west side of Kelly Lane.

At the time, it was also recommended that the cab height remain at 289 feet AGL (2,349 feet AMSL), which corresponded to a viewing height of 294 feet AGL (2,354 feet AMSL) to maximize visibility to all areas of the airport. A letter from the Western Pacific Air Traffic Division (AWP-510), providing the rationale and justification for this 294-foot AGL eye height, is included in Appendix 4.

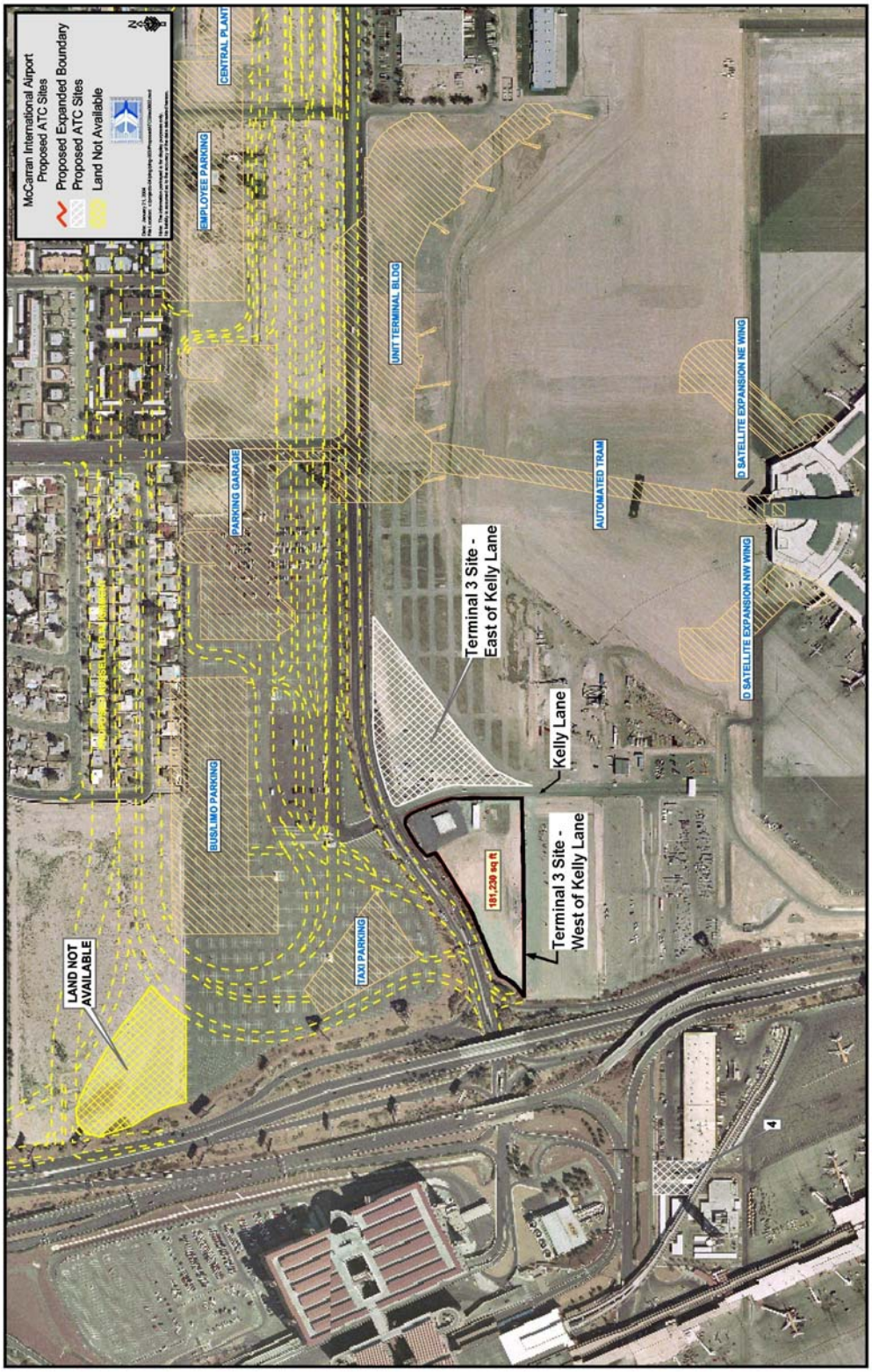

Figure 4 – Revised Terminal 3 Site (West Side of Kelly Lane)

6.2.3 Late-fall 2004 Developments, Impacts, and Conclusions

There were three additional developments in fall of 2004 that further impacted the siting process for this control tower. The first was the realization that a 54-inch water line is located on the southern edge of the Terminal 3 Site on the west side of Kelly Lane. The second was the construction of a new baggage screening facility near the existing Terminal 2 building. Both of these developments have the potential to cause both fiscal and schedule impacts to the project. Lastly, the Clark County DOA plans to construct a "sky bridge" that connects the B Gates and C Gates of Terminal 1.

Shortly after the Terminal 3 Site west of Kelly Lane was selected as the primary location for the new ATCT, a meeting was scheduled with the Clark County DOA to brief them on the decision. During the meeting, one of the DOA attendees from the Planning Department informed the group that a 54-inch water line ran through the southern portion of the site. Rather than locating the new ATCT in the southeastern portion of the site as initially planned, the tower would have to be moved further north around 75 to 100 feet. This adjustment in the location on the site would not impact the line-of-sight from the new tower cab to the airport movement areas; however, it would reduce the amount of security setback distance from the existing public street that borders the northern edge of the site. To reduce or possibly eliminate the impact, the FAA is coordinating with the Clark County DOA to relocate the water line

The Safety Management System (SMS) exercise for the LAS ATCT was scheduled for November 18, 2004 at the AFTIL in Atlantic City, NJ. About a week before the exercise, the local air traffic office noticed some construction activity for a new structure just north of the existing Terminal 2 building and inquired about the building dimensions and usage. The Clark County DOA informed FAA that the new building was a TSA baggage screening facility for Terminal 2. Unfortunately, the height of the structure and close proximity to Taxiway D created a line-of-sight issue from the existing ATCT, and there was concern there would be a similar problem from the proposed Terminal 3 Site. The DOA provided the building statistics and they were forwarded to the AFTIL. The AFTIL modeled the building so the Project Team could evaluate the impacts from each of the potential ATCT sites during the SMS exercise. The tower cab at the Terminal 3 Site west of Kelly Lane had to be raised 48 feet inside the model/simulation to be able to establish the minimum acceptable line-of-sight to Taxiway D behind the new baggage screening building. The new height is not expected to impact any TERPS surfaces; however, the construction costs are expected to increase about $3.0M from $17.958M, as identified in Table 5, to $21.958M.

Although the cost impact is rather severe, the Terminal 3 Site west of Kelly Lane has emerged as the only viable site on the airport for the construction of a new ATCT. As mentioned earlier, an ATCT constructed at Site C would be too close to Wright Brothers Lane and would require substantial blast hardening, which would directly conflict with the seismic requirements at the site. In late November 2004, the FAA learned that the Clark County DOA intends to construct a sky bridge from the B Gates

to the C Gates of Terminal 1 to accommodate Southwest Airlines' growing demand for gate space. The sky bridge will allow the Southwest Airlines passengers with connecting flights to travel directly between the B Concourse and C Concourse without exiting the secured area and having to be screened by security to re-enter. The location of the new sky bridge will virtually eliminate the possibility of constructing a new ATCT at the proposed Terminal B Site.

It is recommended that the ATCT height be increased to maximize the line-of-sight visibility to Taxiway D behind the new TSA baggage screening facility. The new cab height will be 337 feet AGL (2,397 AMSL) and the overall structure height will be 372 feet AGL (2,432 AMSL).

It is further recommended that the Clark County Aviation Department, prior to the start of construction for the new ATCT, decommission, remove, and remediate the compressed natural gas refueling station that is located on the site.

It is further recommended that a Safety Management System (SMS) report be completed for the LAS ATCT siting process. After completion, the SMS Report will be included in Appendix 6 of this Final Siting Report.

It is also recommended that the new ATCT be placed as far west on the west site as possible taking into consideration security setback distances, future expansion capabilities, and overall site development and utilization. Depending on the results of the water line relocation study that the DOA is performing, the ATCT will be located as far south on the property as possible to maximize security setbacks to the extent possible.

A new Airspace Study (Standard FAA Form 7460-1, *Notice of Proposed Construction or Alteration*) was submitting in December 2004 for the site on the west side of Kelly Lane with a new ATCT height of 375' AGL. The associated determination letter, along with the determination letter for the initial sites, is included in Appendix 5. It is recommended that the ATCT include red obstruction lighting. Based on preliminary TERPS evaluation, no TERPS surfaces will be impacted by constructing an ATCT at a height of 375 feet AGL at the Terminal 3 Site west of Kelly Lane.
(Note: The controlling surfaces for TERPS are generated by the CAT I ILS on Runway 25R)

6.2.4 Safety Management System (SMS)

A Comparative Safety Assessment (CSA) has been completed for the LAS ATCT siting. The results of the CSA, which are captured in the Safety Risk Management (SRM) Document, are included in the final report in Appendix 6. The FAA Safety Management System (SMS) Manual defines the process for conducting the CSA in order to ensure the ATCT siting process complies with the goals and objectives of the FAA SMS Manual. Representatives from the Siting Team, including Air Traffic, NATCA, and ANI, participated in the SMS exercise at the AFTIL in Atlantic City, and

the model/simulation was utilized to assess the various hazards at the different sites.

A Preliminary Hazard List (PHL) was used to identify the safety hazards associated with each of the three primary siting options. Hazard analysis worksheets were utilized to document the severity of the consequences and the likelihood of occurrence for the different hazards. After each site was evaluated, the hazards were compared using a Risk Matrix for relative hazard ranking. For the purposes of applying SMS to the ATCT siting process, the CSA only considered hazards that may impact aviation safety.

As summarized in the SRM Document in Appendix 6, the Terminal 3 Site has the lowest relative safety risk ranking; therefore, it has the most favorable safety profile of all three of the primary sites. The Terminal 3 Site has no high-risk hazards, no medium-risk hazards, and 16 low-risk hazards. The Terminal B site had one high-risk hazard, no medium-risk hazards, and 15 low-risk hazards, while Site C had no high-risk hazards, one medium-risk hazard, and 15 low-risk hazards. For the purposes of SMS, the low-risk hazards need to be documented, but do not have to be mitigated and tracked to closure like the medium and high hazards.

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Appendix 1 – List of Contacts

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Appendix 2 – Shadow Diagrams for Existing ATCT and Primary Siting Options

Existing ATCT – 185 feet AGL Viewing Height

Site C – 200 feet AGL Viewing Height

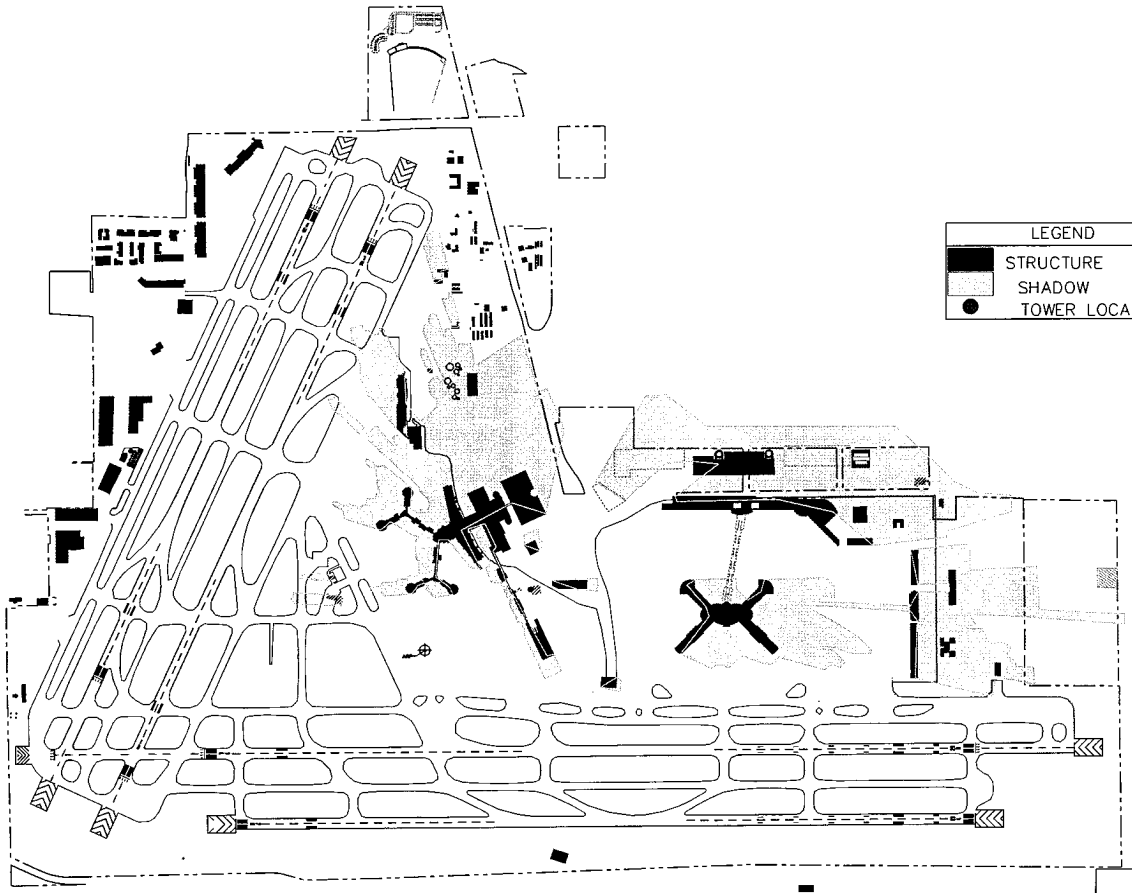
Site C – 265 feet AGL Viewing Height

Terminal B – 200 feet AGL Viewing Height

Terminal B – 254 feet AGL Viewing Height

Terminal 3 – 250 feet AGL Viewing Height

Terminal 3 – 294 feet AGL Viewing Height



LEGEND
STRUCTURE
SHADOW
TOWER LOCATION

CONTROLLER EYE LEVEL
185 FT. AGL
2275 FT. MSL

PRELIMINARY

NOTE:
BUILDING HEIGHTS ARE BASED ON VALUES PROVIDED BY THE CUSTOMER. HEIGHTS THAT WERE NOT PROVIDED BY THE CUSTOMER ARE ESTIMATED FROM ON-SITE PHOTOGRAPHS. SHADOWS ARE CAST TO TERRAIN DERIVED FROM 10' CONTOURS PROVIDED BY CLARK COUNTY DEPT. OF AVIATION, ALP FAA APPROVED 9-24-2002

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER ATLANTIC CITY NJ

ATCT SITING STUDY

LAS CURRENT TOWER SITE
SHADOW STUDY EXHIBIT

REVIEWED BY	SUBMITTED BY	APPROVED BY	
DESIGNED	ISSUED BY AIRWAY FACILITIES DIVISION	DATE	5-7-04
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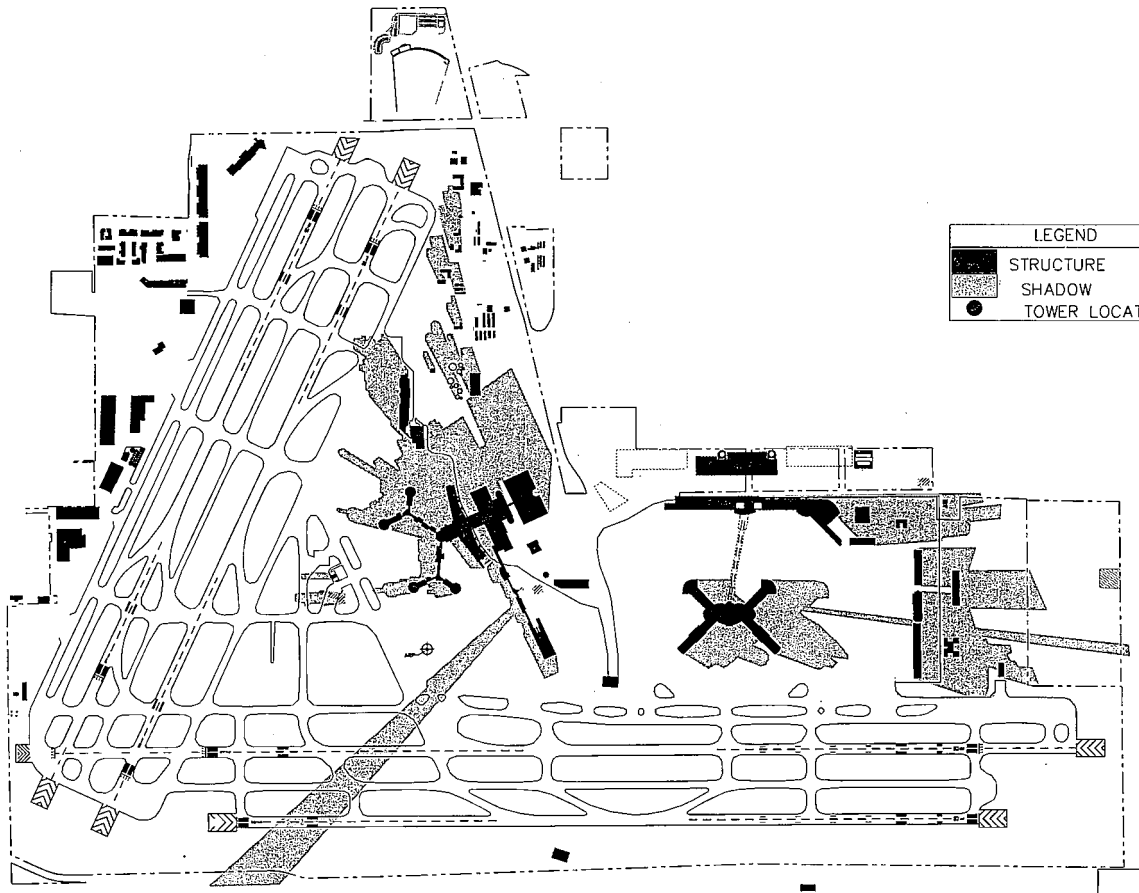

CONTROLLER EYE LEVEL
200 FT. AGL
2289 FT. MSL

PRELIMINARY

NOTE:
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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER ATLANTIC CITY NJ

ATCT SITING STUDY
LAS TOWER SITE (SITE C)
SHADOW STUDY EXHIBIT

REVIEWED BY	SUBMITTED BY	APPROVED BY	
	DESIGNED	ISSUED BY AIRWAY FACILITIES DIVISION	DATE 5-7-04
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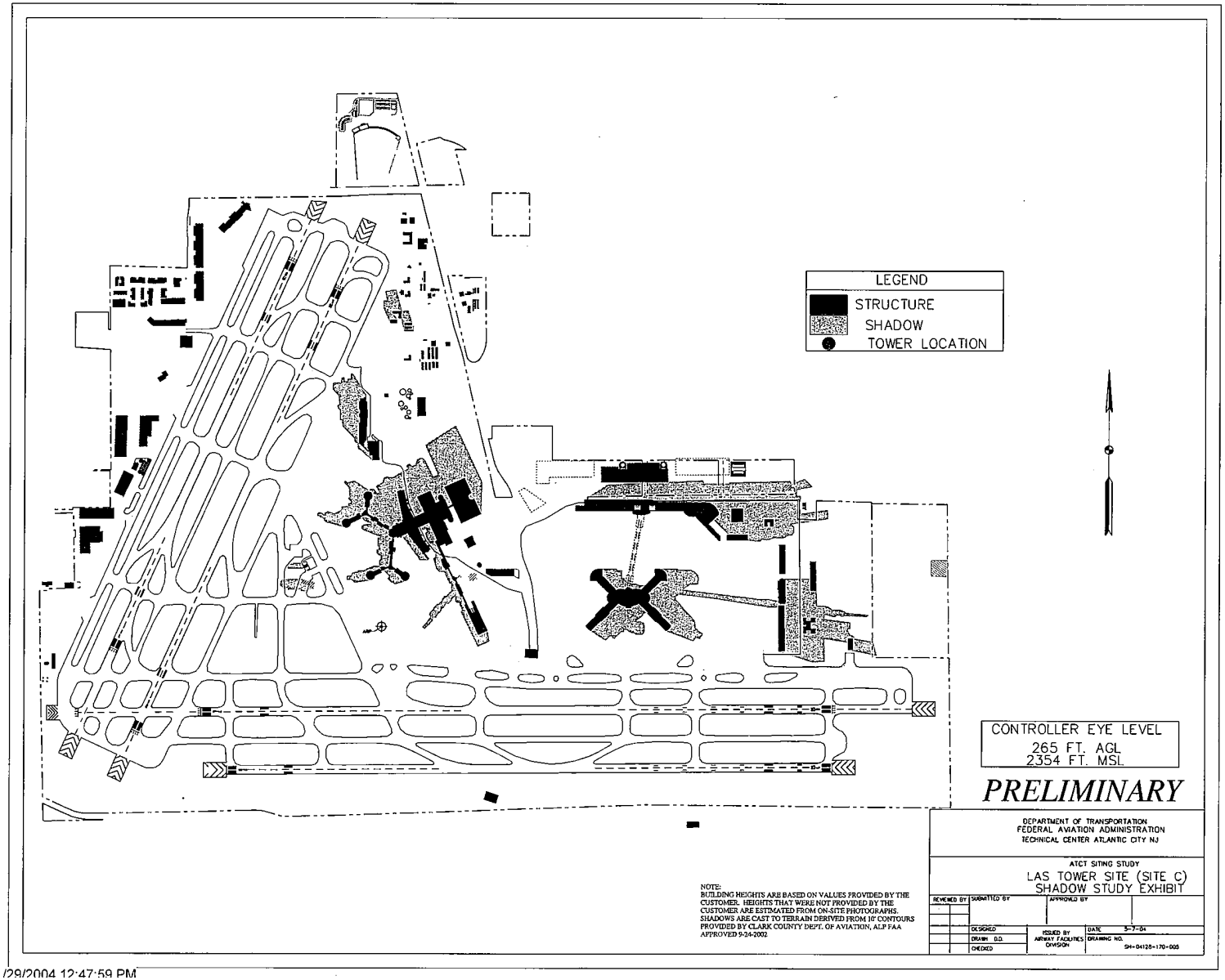

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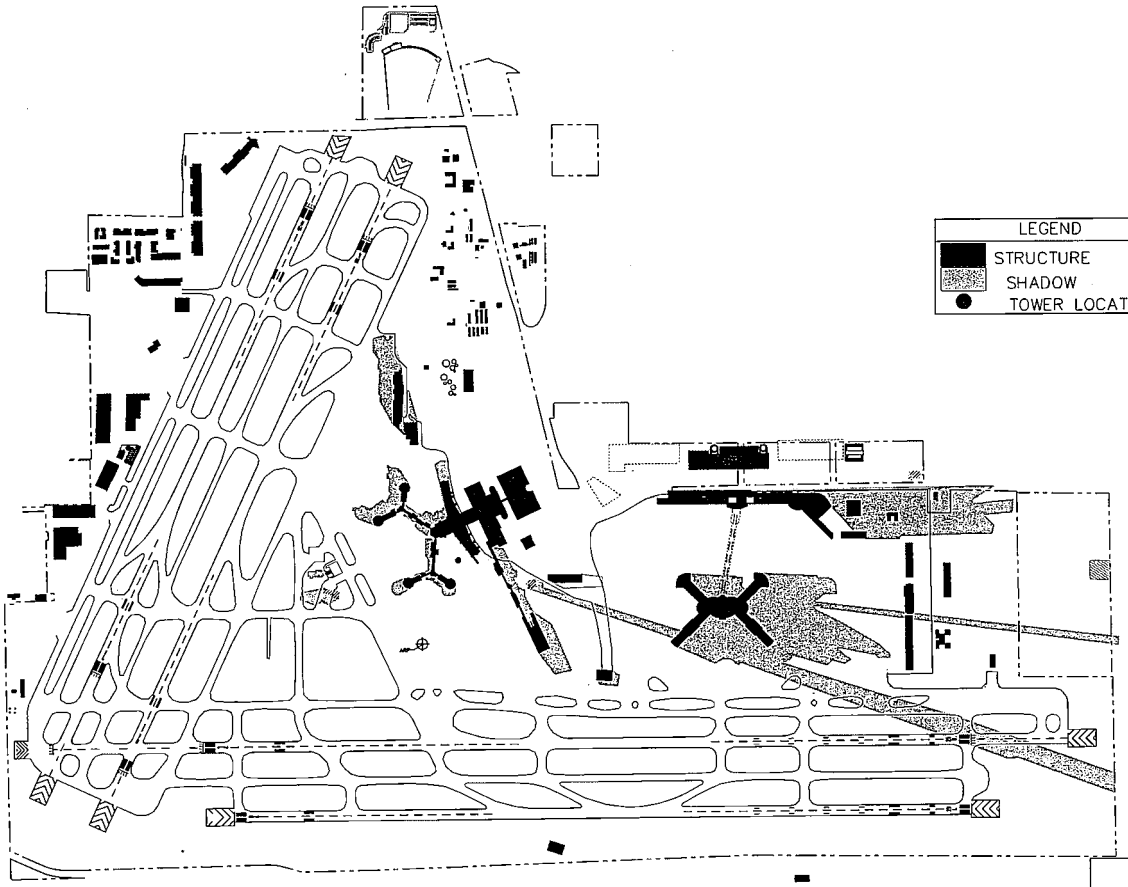


CONTROLLER EYE LEVEL
200 FT. AGL
2300 FT. MSL

PRELIMINARY

NOTE:
BUILDING HEIGHTS ARE BASED ON VALUES PROVIDED BY THE CUSTOMER. HEIGHTS THAT WERE NOT PROVIDED BY THE CUSTOMER ARE ESTIMATED FROM ON-SITE PHOTOGRAPHS. SHADOWS ARE CAST TO TERRAIN DERIVED FROM 10' CONTOURS PROVIDED BY CLARK COUNTY DEPT. OF AVIATION, ALP FAA APPROVED 9-24-2002.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER ATLANTIC CITY NJ

ATCT SITING STUDY

LAS TOWER SITE (TERM B)
SHADOW STUDY EXHIBIT

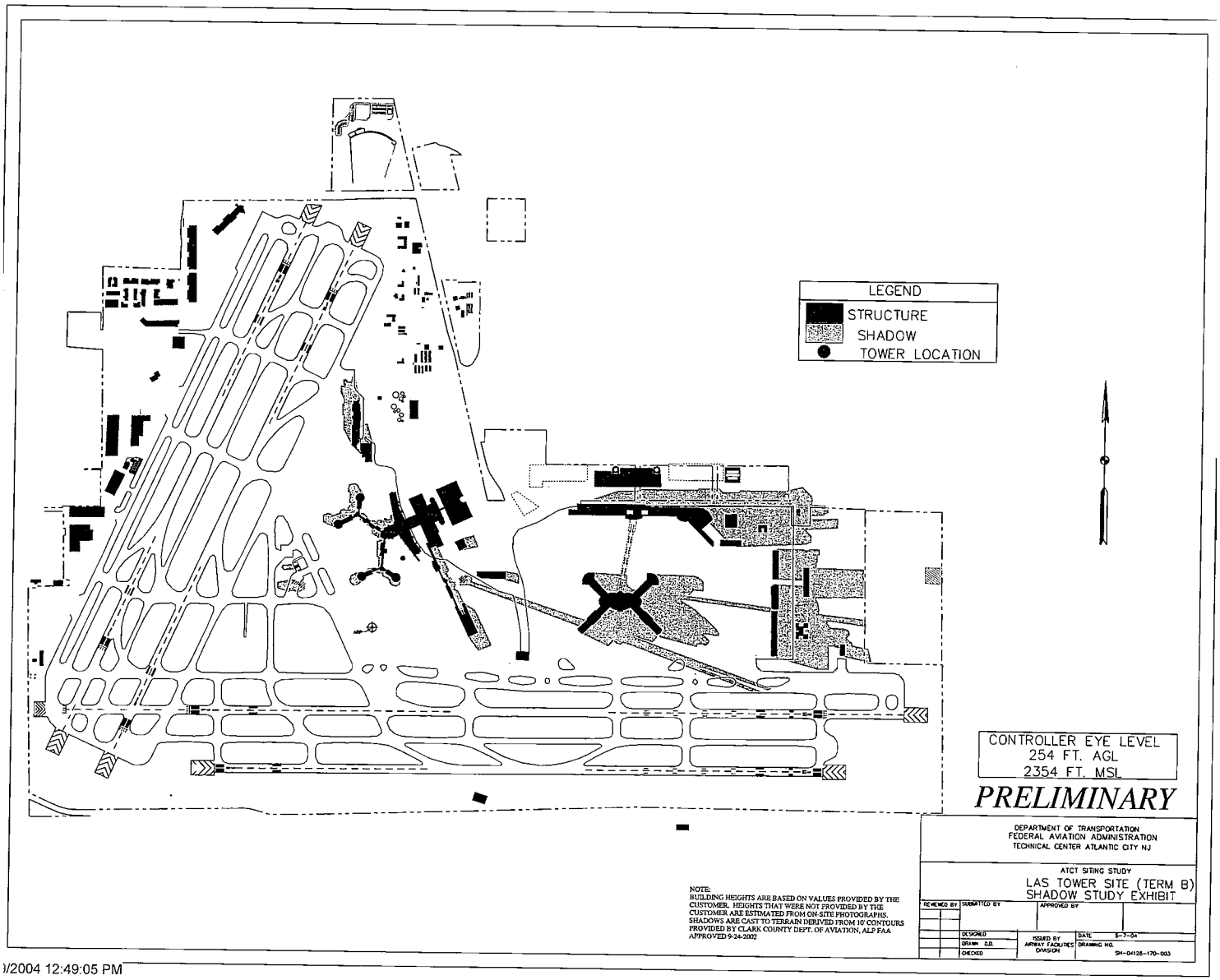
REVIEWED BY	SUBMITTED BY	APPROVED BY

DESIGNED
DRAWN D.D.
CHECKED

ISSUED BY AIRWAY FACILITIES DIVISION

DATE 5-7-04

DRAWING NO. SH-04128-170-004



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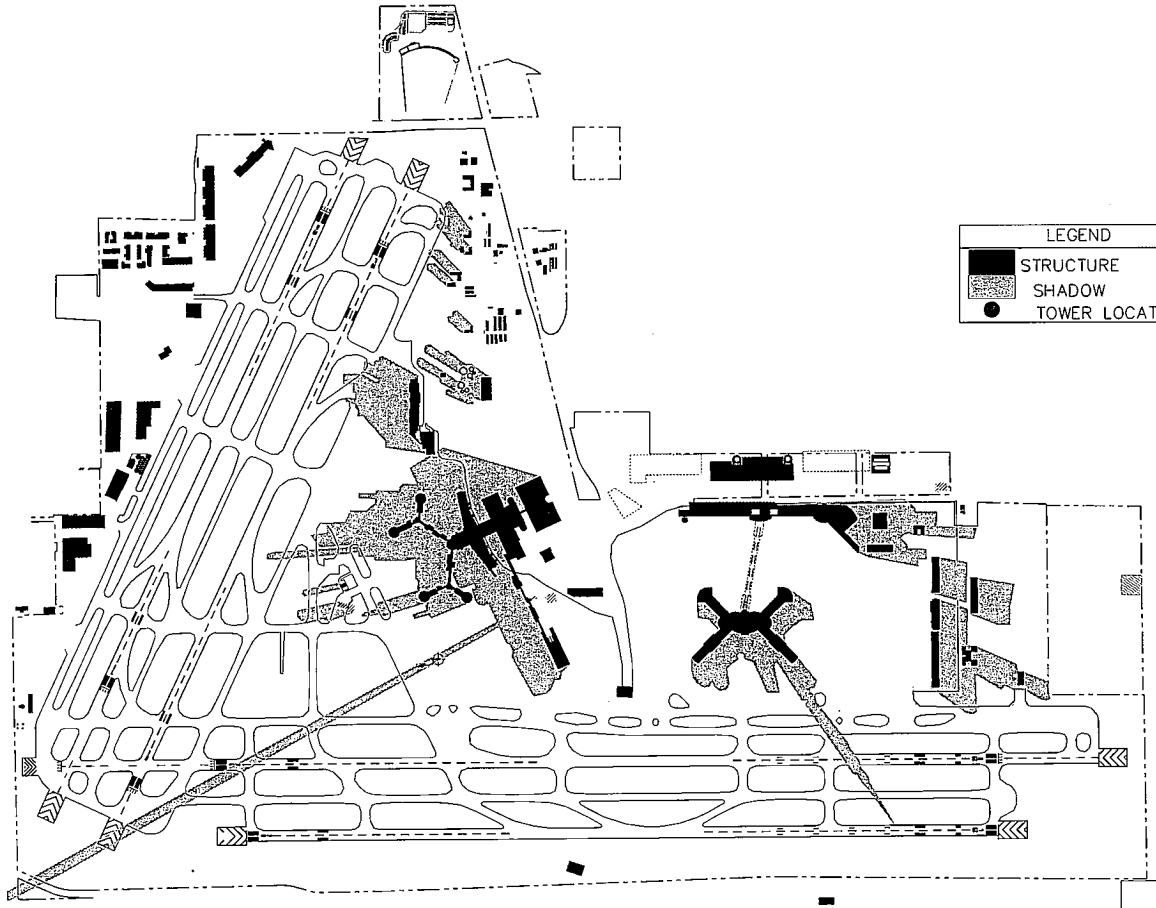

CONTROLLER EYE LEVEL
250 FT. AGL
2310 FT. MSL

PRELIMINARY

NOTE:
BUILDING HEIGHTS ARE BASED ON VALUES PROVIDED BY THE CUSTOMER. HEIGHTS THAT WERE NOT PROVIDED BY THE CUSTOMER ARE ESTIMATED FROM ON-SITE PHOTOGRAPHS. SHADOWS ARE CAST TO TERRAIN DERIVED FROM 10' CONTOURS PROVIDED BY CLARK COUNTY DEPT. OF AVIATION, ALP FAA APPROVED 9-24-2002.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER ATLANTIC CITY NJ

ATCT SITING STUDY

LAS TOWER SITE (TERM3)
SHADOW STUDY EXHIBIT

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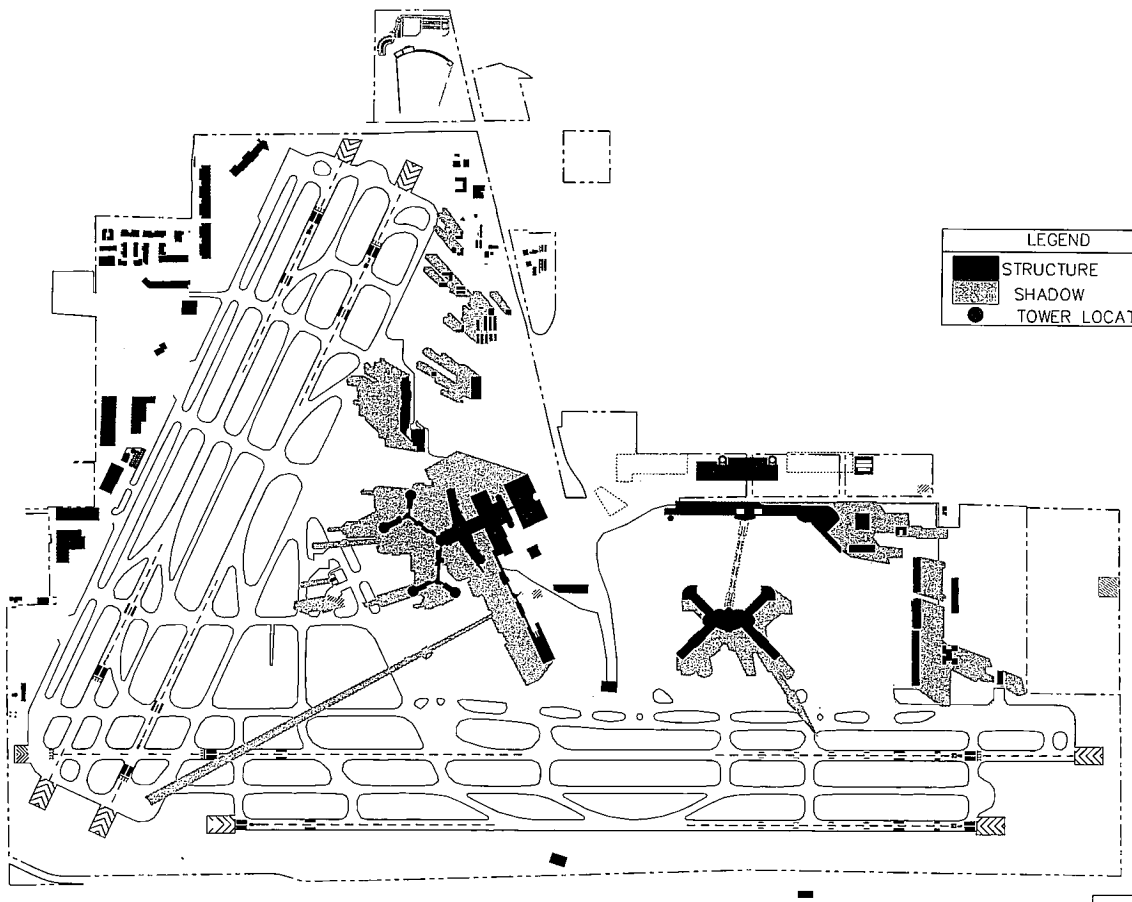

CONTROLLER EYE LEVEL
294 FT. AGL
2354 FT. MSL

PRELIMINARY

NOTE:
BUILDING HEIGHTS ARE BASED ON VALUES PROVIDED BY THE CUSTOMER. HEIGHTS THAT WERE NOT PROVIDED BY THE CUSTOMER ARE ESTIMATED FROM ON-SITE PHOTOGRAPHS. SHADOWS ARE CAST TO TERRAIN DERIVED FROM 10' CONTOURS PROVIDED BY CLARK COUNTY DEPT. OF AVIATION, ALP FAA APPROVED 9-24-2002

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER ATLANTIC CITY NJ

ATCT SITING STUDY
LAS TOWER SITE (TERM 3)
SHADOW STUDY EXHIBIT

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	DESIGNED	ISSUED BY AIRWAY FACILITIES DIVISION	DATE 5-7-04
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Appendix 3 – Jacobs Engineering Construction Feasibility Study for Site C

United States Department of Transportation / Federal Aviation Administration (FAA)
McCarren International Airport
Las Vegas, Nevada

Las Vegas (LAS) Airport Traffic Control Tower (ATCT)

Tower Constructability Issues

Jacobs was tasked with visiting the existing FAA ATCT/TRACON facility at McCarren International Airport to investigate and assess the impact that site constraints might have on the design and construction of a new tower on the existing site. Jacobs met with representatives on ANI-450 on the site on May 17, 2004, and the issues noted herein are based on observations made during that visit. ANI-450 subsequently conducted a meeting with the Clark County Aviation Department.

New ATCT Project

FAA is considering locating a new 265 feet tower on the northeast corner of the existing site, approximately where the present exit queuing for the main gate takes place. The new tower is proposed to follow the FAA's standard Leo Daley design, and would be similar to Jacobs' recent design for the new Dulles Tower, with an 850 so cab and with two stairs. Following the design of other structures on the site the new tower will likely require a deep foundation design consisting of a reinforced concrete cap resting on an array of drilled concrete piers. This proposed location will require a physical access link to the existing base building (TRACON), a communications ductbank tie-in to the existing system, a relocation of the site entry gate and security control system, and a reconfiguration of personnel access and parking.

Proposed Site

The portion of the site under consideration is limited in size and has a number of encumbrances, which will adversely impact the construction operations. The proposed construction site is a triangle approximately 250' by 350' by 100'. A depressed roadway for airport baggage operations runs along the East property line and becomes a tunnel as it curves across the Northeast corner of the site. Along the Northern property line is a small, two-lane, dead-end road (Wright Brothers Lane), which provides access to tenant property on both sides of the FAA facility. An elevated people mover forms the third side of the triangle by diagonally traversing the site from the Northwest corner to the midpoint on the Eastern property line (crossing the approach to the baggage tunnel).

These encumbrances bring a number of challenges to the viability of the project, some of which can be overcome but at significant expense. Each concern is addressed below, and, if appropriate, a recommendation is presented on how to mitigate the risks associated with the concern. Wherever possible, a Rough Order of Magnitude (ROM) statement of the impact to construction cost and schedule is included. For purposes of relative comparison, it is assumed the baseline is a new tower of pre-cast concrete construction located on an unencumbered site with a construction budget of $14 million and a construction schedule of 12 months.

Issue 1 IBC Code Compliance and Seismic

Depending upon various Seismic Design Categories, the International Building Code (IBC) sets height limitations for various types of structural systems. Given the combination of ground acceleration, soils profile and building use category, it is likely the new LAS ATCT tower will fall in IBC Seismic Design Category "D." IBC Table 1617.6 indicates that the type of structural system used in both the recent Dulles (IAD) and Phoenix (PHX) new ATCT towers (ordinary reinforced concrete shear walls in a bearing wall system) is not permitted in IBC Seismic Design Category "D." In fact, all bearing wall and building frame structural systems are either not permitted by the IBC or have their heights capped at 160 feet if allowed at all.

The permissible structural systems allowed by the IBC for a tower of a height greater than 160 feet are moment-resistant systems or dual systems with special moment frames. The older Uniform Building Code (UBC) previously used for FAA towers had similar restrictions with regard to structural systems, albeit not as stringent as the current IBC criteria. This is why the standard major activity towers built in the 1990's had both an "east coast" and "west coast" standards. The east coast versions employed a concrete bearing wall system (for example, the recent Newark ATCT), while the west coats versions employed a steel structure (for example, the Los Angeles ATCT).

Specific site and soil conditions for the new LAS tower have not been fully investigated or evaluated, however it seems likely a steel frame tower design for a significant portion of the tower than just the top sections will most likely be required for IBC compliance. If the recent Dulles tower design were used as the basis for the new LAS tower, significant revisions to the structural system would therefore be required.

A ROM projected construction cost premium for revising the FAA standard Leo Daley (or Dulles) tower structural design for LAS conditions and IBC compliance is $500,000.

Issue 2 Blast Criteria Compliance

Due to the short distances between potential events and the new tower, standoff distances cannot be met, and blast criteria will have extraordinary impact on the design. The setback from Wright Brothers Lane is only about 35 feet. The baggage tunnel and the elevated people mover, although part of restricted airport operations, are not secure and therefore may be considered as potential event areas. These adjacencies would drive an otherwise typical 12-inch thick concrete wall to be increased to 30 inches or more. The underside of the cab structure would also need to be substantially hardened. The hardening, which is typically accomplished with concrete, is in direct conflict with the flexible nature of the structures required for seismic compliance. It appears that the project cannot be designed to meet both sets of criteria with the limitations imposed by this site. A variance to the criteria or a different site selection is the choice open to FAA.

A ROM projected construction cost premium for revising the FAA standard Leo Daley (or Dulles) tower structural design for blast criteria compliance within the limited setbacks of the proposed LAS site is $2,500,000.

Issue 3 Elevated People Mover (EPM)

The continued operation of the EPM during construction of the new tower on the existing site is an extraordinary risk. Jacobs concurs fully with Clark County Aviation Department's (the airport) requirement that no crane lifts be made across (above) the EPM. Because of the inadequate setbacks on the proposed site, the EPM falls within the high risk shadow "umbrella" of the tower construction and therefore must be protected against overhead construction activities. Typical fall protection netting below the upper level of construction will not be adequate for protection of the people in the buses on the EPM. Accordingly, Jacobs recommends a temporary structural shield around the EPM for a distance of approximately 150 lineal feet. A shield may also be required for approximately 50 lineal feet of the baggage roadway/tunnel.

A ROM projected construction cost premium for the EPM protective tunnel is $325,000. Note that the tunnel will further constrict the area available for tower construction.

Issue 4 Sustaining FAA Operations and Security

The FAA operations of the ATCT and TRACON must continue during the construction of the new tower. Access to the facility for personnel and deliveries must be maintained separate from the construction operations by fencing for segregation of operations, personnel safety and facility security. The new construction fencing would displace about half of the existing employee parking. A conceptual solution would be for the Airport and FAA to allow FAA personnel to park in the tenant surface parking area adjacent to the facility on the West and to access that parking from the airport departures roadway. A ramp driveway from the West lot to the FAA facility and parking would be required as would relocation of gating and temporary line-of-sight security operations. Personnel vehicles and deliveries exiting the facility site would exit directly onto the airport departing flights roadway and not Wright Brothers Lane.

A ROM projected construction cost premium for sustaining FAA operations and security is $100,000.

Issue 5 Construction Traffic

Construction deliveries of highway trailers most likely would approach along Wright Brothers Lane from the East, negotiate a turn around, and then exit out Wright Brothers Lane. The potential approach to the site through the airport has two disqualifiers. First is the impact to the public traffic negotiating drop-offs for departures and general congestion in the departing flight lanes. Second is the 13' height restriction below the EPM as it crosses the roadway. The paved roadway at the dead end of Wright Brothers Lane has sufficient turning radius for trailers heading West to make a left turn after crossing under the EPM, enter the FAA site from the West, angle North between the sets of columns and climb back up to Wright Brothers Lane heading East. The virtue of

this approach is the separation of construction traffic from the airport traffic and the control of construction only traffic on Wright Brothers Lane.
Additional fencing, gating, grading and manual traffic control would be required to implement.

A ROM projected construction cost premium for the construction traffic issues is $150,000.

Issue 6 Tower Crane and Inadequate Site

The positioning of the tower crane on the site has three restrictions. First it should be located on the street side of the site and as much counterclockwise as possible to minimize the visual interference to the existing tower operations. Second it must be West of a 30 feet setback from the baggage tunnel. Third it should be within about 40 feet of the tower for a structural support connection between the tower and the crane at two-thirds of its height. Jacobs recommends that a shoring system would be installed along the departing flights roadway so that the landscaped berm area can be excavated and that Wright Brothers Lane be relocated to the North to provide a buffer between the trailer unloading/traffic lane and the tower crane base. Wright Brothers Lane would be closed to through traffic and the entire area fenced and gated.

The available lay-down area for queuing of materials is inadequate for a project of this size. The proximity of the delivery road and the EPM compromise the area adjacent to the vertical construction. Therefore all materials must be staged offsite and brought to the construction operations on an as needed basis to be offloaded and sequenced in erection. Only as much material as can be either installed or staged on site can be delivered at one time. This limiting factor will increase the number of deliveries and will extend the construction duration.

A ROM projected construction cost premium for the tower crane and inadequate site issues is $4,000,000 and two months.

Appendix 4 – Coordination Letters

December 15, 2003 – Clark County Department of Aviation (2 pages)

Letter from the Department of Aviation that identifies the available ATCT sites on the airport. It identifies the two Kelly Lane sites (#2 and #3) as well as the Terminal B (#1) site as viable options. It also eliminates the Russell Road site (area to the northwest of the bus/limo parking) from consideration. Since the Sunset Road site is off-airport property, it is not identified here as a viable option; however, it was under consideration at the time this letter was written. The attached sketch depicts the approximate property boundaries of the various potential sites. Of the two Terminal 3 sites shown, the site on the east side of Kelly Lane (#3) was the preferred location because of its larger size.

February 2004 – Clark County Department of Aviation (2 pages)

As a routine procedure, the various offices within the Clark County Department of Aviation conduct a review of all proposed projects that will affect the airport. This document was received in February of 2004 and addresses the various potential sites that were under consideration at that time. The Terminal B site is the only site specifically discussed, and all of the comments are negative.

July 23, 2004 – Clark County Department of Aviation (2 pages)

This letter from the Clark County Department of Aviation discusses recent changes to the Terminal 3 building design that will reduce the size of the Kelly Lane site east of Kelly Lane (Site 3). It also confirms that the Department of Aviation is willing to increase the size of the Terminal 3 site west of Kelly Lane (Site 2) to 165,800 square feet (3.8 acres) from its original 1.5 acres. Lastly, the letter discusses the Sunset Road site and the fact that the rising cost of real estate in the Las Vegas area has made the site unattainable for the Aviation Department. The attached sketch depicts the proposed changes to the site on the west side of Kelly Lane

October 4, 2004 – Area Director, Western Terminal Operations

This letter from the Western Terminal Operations office provides the explanation and justification for a minimum eye height of 294 feet AGL for the new ATCT.

LAS VEGAS
McCARRAN INTERNATIONAL AIRPORT

Department of Aviation

RANDALL H. WALKER
DIRECTOR

ROSEMARY A. VASSILIADIS
DEPUTY DIRECTOR

POSTAL BOX 11005
LAS VEGAS, NEVADA 89111-1005
(702) 261-5211
FAX (702) 597-9553
E-MAIL: webmaster2@mccarran.com

December 15, 2003

Mr. Ed Felipe, ANI-940
Federal Aviation Administration
Western-Pacific Regional Headquarters
P.O. Box 92007
Los Angeles, CA 90009-2007

Subject: Possible sites for new air traffic control tower at McCarran International Airport

Dear Mr. Felipe:

You recently requested that the Clark County Department of Aviation (DOA) advise you in writing regarding possible sites for a new air traffic control tower at McCarran International Airport. Attached is a graphic depiction of possible sites on land owned by the DOA. You should note that the depiction of the available sites is not a legal description of the land. It is provided in order to assist in your planning activities. Once you have narrowed your considerations to a specific site, my staff can assist you is determining the exact dimensions of the available land.

The possible sites are labeled one through three, and are located:

1) in the cul-de-sac adjacent to the 'B' concourse where the DOA is losing apron space for new security requirements;
2) west of Kelly Lane, on land currently being used for a compressed natural gas station; and
3) east of Kelly Lane, on land that had been planned for the new Terminal 3.

The FAA would, of course, also be free to consider building on the land you currently lease for the existing tower and TRACON. Additionally, I have labeled land northwest of the future bus/limo parking area as not available in response to interest shown by your task force.

Should you have further requirements, please coordinate them with Mr. Mike Loghides, Airport Program Administrator, 702-261-5750.

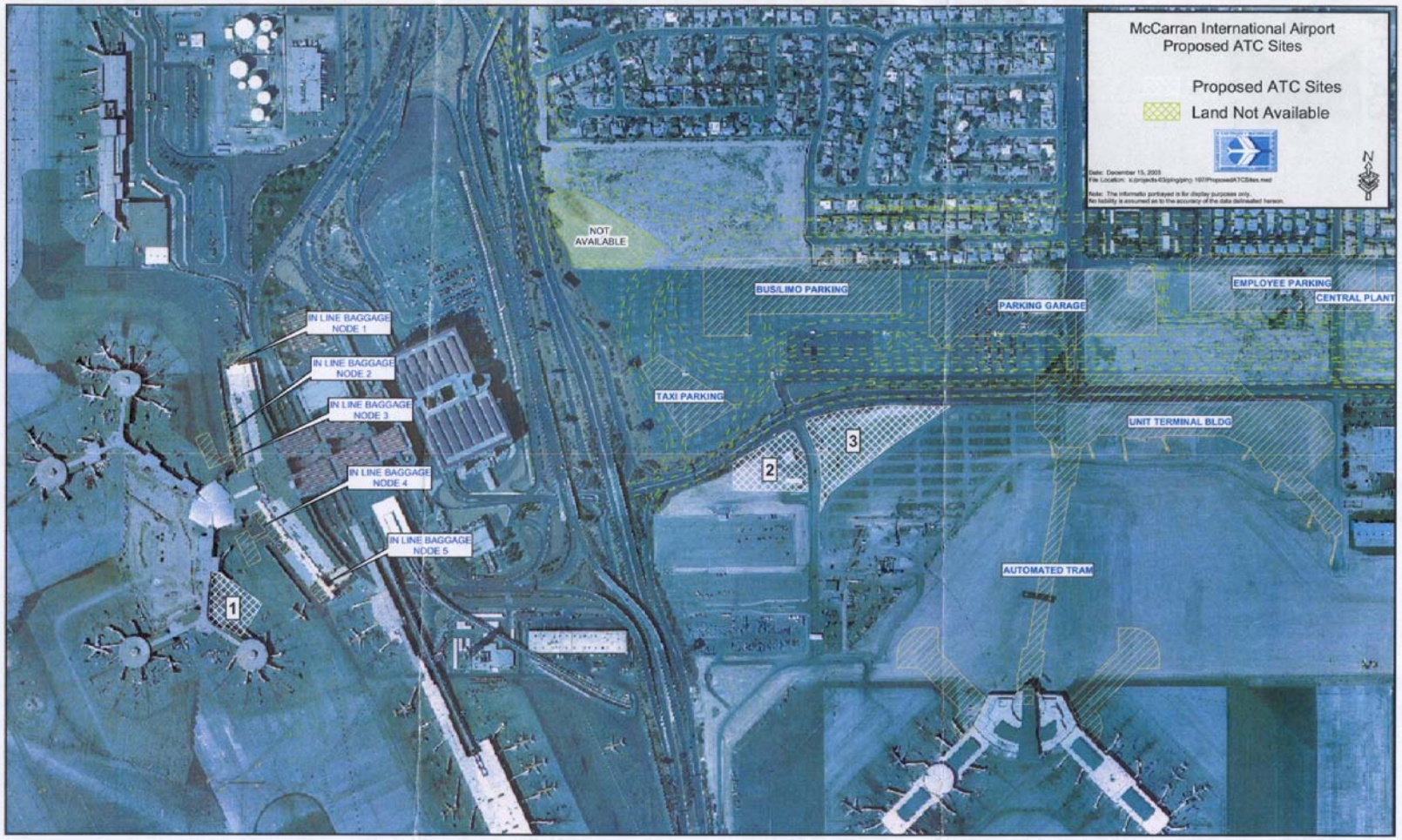
Sincerely,

RANDALL H. WALKER
Director of Aviation

RHW:ra

Attachment

cc: Mike Loghides


McCarran International Airport
Proposed ATC Sites
Proposed ATC Sites
Land Not Available
Date: December 15, 2005
File Location: k:\projects-43\pig\pig1\ 107\ProposedATCSites.mxd
Note: The information portrayed is for display purposes only.
No liability is assumed as to the accuracy of the data delineated hereon.
N
NOT AVAILABLE
BUS/LIMO PARKING
PARKING GARAGE
EMPLOYEE PARKING
CENTRAL PLANT
IN LINE BAGGAGE NODE 1
IN LINE BAGGAGE NODE 2
IN LINE BAGGAGE NODE 3
IN LINE BAGGAGE NODE 4
IN LINE BAGGAGE NODE 5
TAXI PARKING
UNIT TERMINAL BLDG
AUTOMATED TRAM
1
2
3

PROJECT CONCEPT APPROVAL FORM

PROJECT NAME: Proposed ATC Sites TENANT IMPROVEMENT # ONE

DIVISION: Planning ORIGINATOR'S NAME AND PHONE #: Mike Loghides

PROJECT COORDINATOR: _____ PROJECT TYPE: DOA ☐ or Tenant ☐

Main Lessee: _____ Sublessee: _____

PROJECT LOCATION (Check One): McCarran ☒ Terminal 1 ☐ Terminal 2 ☐ Terminal 3 ☐

North Las Vegas ☐ Jean ☐ Searchlight ☐ Overton ☐ Ivanpah ☐ Henderson ☐

Level: _____ Building: _____ Area: _____ Door #: _____

Comments: The FAA is planning to construct a new ATC for McCarran Int. Airport. Please see the attached map for three possible sites under analysis for the proposed location of a new Air Traffic Control Tower.

If necessary, please attach a separate sheet of paper with additional comments.

Finance (Contact: Scott Kichline)

Name: Scott Kichline Signature: _____ Date: 2/9/04

Comments:

Planning & Construction (Contact: Betty Ann Caldwell) DATE RECEIVED: 2/9/04

Name: Carrol Patton Signature: Carrol Patton Date: 2/9/04

Name: Terry Cupp Signature: Terry Cupp Date: 2/10/04

Name: _____ Signature: _____ Date: _____

Comments: The site near the A-B Gates will conflict with In line Baggage

Airside Operations (Contact: Bill Klein)

Name: Dennis Monahan Signature: _____ Date: 2-9-04

Comments: Bill Klein Bill K 2-9-04

Prefer not to have the one near A/B, Gates

Information Systems (Contact: Samuel Ingalls)

Name: _____ Signature: _____ Date: _____

Comments: (S.I. out of office until 2/13)

Facilities/Maintenance (Contact: BERT FRATTINI

Name: BERT FRATTINI Signature: _____ Date: 2-10-04

Comments:

BELIEVE A/B GATE AT EXISTING TOWER LOCATION WOULD RESTRICT FENCE AGAINST GROUND.

Terminal Operations (Contact: Ralph LePore)

Name: _____ Signature: _____ Date: _____

Comments:

Landside Operations (Contact: Harry Waters)

Name: _____ Signature: _____ Date: _____

Comments:

Director's Office

Safety and Environmental (Contact: Chuck Giesler)

Name: CHUCK GIESLER Signature: _____ Date: 2/9/04

Comments:

Name: _____ Signature: _____ Date: _____

Comments:

Security (Contact: Al Krisch)

Name: AL KRISCH Signature: _____ Date: 2/11/04

Comments: A/B would have security implications & blockview of West Ramp Control.

Last (Contact: Randall H. Walker or Rosemary A. Vassiliadis)

Signature: _____ Approved: ☐ Denied: ☐ Date: _____

Comments:

LAS VEGAS
McCARRAN INTERNATIONAL AIRPORT

Department of Aviation

RANDALL H. WALKER
DIRECTOR

ROSEMARY A. VASSILIADIS
DEPUTY DIRECTOR

POSTAL BOX 11005
LAS VEGAS, NEVADA 89111-1005
(702) 261-5211
FAX (702) 597-9553
E-MAIL: webmaster2@mccarran.com

July 23, 2004

Mr. Darren Brinker
Federal Aviation Administration
Central Region Headquarters, ANI-540
901 Locust Street
Kansas City, Missouri 64106

Dear Mr. Brinker:

As you are aware, the Clark County Department of Aviation (DOA) has been working with the Federal Aviation Administration (FAA) for approximately two years on identifying a site for a new air traffic control tower to serve McCarran International Airport (LAS). Over the course of our work, I have proposed several sites, currently identified as:

Site 1 – a location south of Sunset Road, situated outside the airport, on land the DOA might be able to obtain;
Site 2 – a location on airport property located at the southwest corner of Kelly Lane and the current alignment of Russell Road; and
Site 3 – a location on airport property located at the southeast corner of Kelly Lane and the current alignment of Russell Road.

As I informed the FAA in late April 2004, due to the fast-rising cost of land in the Las Vegas Valley, the DOA was no longer in a position to obtain the land in question at **Site 1**.

I have attached an aerial view of the remaining sites, identified as **Site 2** and **Site 3**. Due to changing demands on LAS infrastructure, the west end of the future building identified on the aerial as 'Unit Terminal Building' will now be built over at least half of the available land at **Site 3**. The Aerial does not show the new layout, but I recently sent you a graphic depiction of the footprint of this building and its impact on **Site 3**. I doubt that the area available will now suit your purposes.

As regards **Site 2**, I have identified the original amount of land that was proposed to the FAA. I have also outlined in red an area identified as 'proposed expanded boundary,' which is land that is available to the FAA in addition to the original proposal. In total, the area of available land is approximately 165,800 square feet. Additionally, the shaded area south of **Site 2**, labeled 'reservoir' is an area that could be made available for uncovered parking should the FAA find it appropriate.

Hopefully, this will clarify the current situation regarding airport land. Should you have any comments, please feel free to contact me at 702-261-5750 or mikelo@mccarran.com

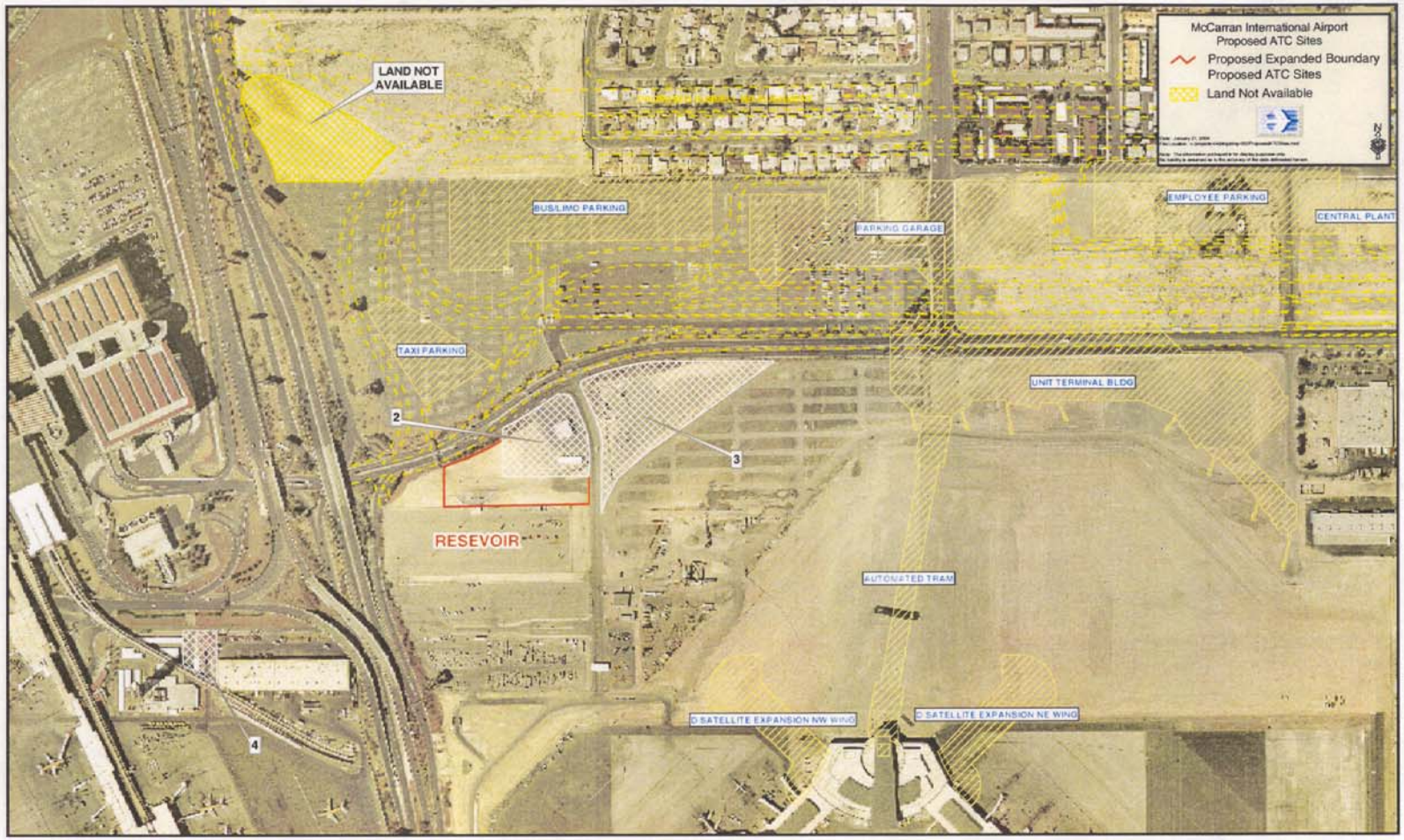
Sincerely,

CONSTANTIN. M. LOGHIDES
Airport Program Administrator

CML:lp

Enclosure

cc: Dennis Mewshaw


McCarran International Airport
Proposed ATC Sites
Proposed Expanded Boundary
Proposed ATC Sites
Land Not Available
LAND NOT AVAILABLE
BUS/LIMO PARKING
PARKING GARAGE
EMPLOYEE PARKING
CENTRAL PLANT
TAXI PARKING
UNIT TERMINAL BLDG
2
3
RESEVOIR
AUTOMATED TRAN
D SATELLITE EXPANSION NW WING
D SATELLITE EXPANSION NE WING
4

U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: **ACTION**: Las Vegas New Control Tower Height Requirement

Date: OCT - 4 200

From: Area Director, Western Terminal Operations

Reply to Attn. of:

To: Director, Terminal Operations
Director, Terminal Planning

Order 6480.4, Airport Traffic Control Tower Siting Criteria, establishes the mand itory requirements for determining the height of all new/replacement air traffic control owers. The visibility requirements are that there be maximum visibility of the airborne tr ffic pattern; and that complete visibility must be available to all airport surfaces utiliz d for movement of aircraft, which are under the control of the airport traffic control tov er.

In June 2004 selected team members representing NATCA, Management, ANI-5/), and AFTIL staff members, met to determine the "minimum" height required to compl with Order 6480.4. The two areas in question that needed to be resolved were, the visi ility over Terminal 2 to see taxiway "D", and the visibility over the Ramp Tower to se taxiway "G."

The simulation began at 250 feet above ground level and ended at 325 feet above round level. The simulation was adjusted to determine what height could be established n which aircraft on taxiway "D" and "G" could be seen for ground control purposes With the Cab Floor height at 294 feet, taxiway "G" could be seen. And, although taxiw ıy "D" behind Terminal 2 is not visible, enough of the aircraft's body is seen to effectivel control ground traffic in that area.

The minimum tower viewing height, needed to provide a 35-minute viewing angl to all airfield surfaces, was calculated to be approximately 162 feet above ground level. However, based on the AFTIL model/simulation, the tower viewing height, neede to provide visibility to all runways and taxiways, was determined to be **294** feet abov ground level. The total ATCT height would be approximately **324** feet above grou nd level, assuming a 30-foot height of tower cab roof structure, antennas, air terminal , or other appurtenances above the viewing height (35 feet above the cab floor height).

After careful consideration and review of the criteria and requirements of Order (480.4, we have concluded that 294 feet above ground level meets the visibility requirem nts for establishing a new ATCT at the "Terminal 3 Site" for Las Vegas International Ai port. This height is the minimum necessary to meet Las Vegas visibility requirements. nd also meets current Terminal Instrument Procedures (TERPS) criteria.

If you have any questions or need further information, please contact Wayne Mac Kenzie, Manager, Program Operations, at (310) 725-6510.

for John Clancy

Appendix 5 – Airspace Study Determination Letters

March 19, 2004 – FAA via Clark County Department of Aviation (2 pages)
This letter was generated by the San Francisco Airports District Office and forwarded to the Director of Aviation at McCarran Airport. The letter discusses the results of the initial airspace studies that were requested for each potential site. The letter does not identify any objections with any of the sites; however, it reiterates the concerns of the Airport personnel concerning the Terminal B site.

March 24, 2005 – FAA via Clark County Department of Aviation (2 pages)
This letter was generated by the San Francisco Airports District Office and forwarded to the Director of Aviation at McCarran Airport. The letter discusses the results of the follow-up airspace study that was requested for the Terminal 3 Site west of Kelly Lane with an estimated overall structure height of 357 feet AGL. The letter does not identify any objections with any of the sites; however, it recommends lowering construction equipment at night and providing red obstruction lighting on the building.

U.S. Department
of Transportation
**Federal Aviation
Administration**

**San Francisco Airports District Office
831 Mitten Road, Room 210
Burlingame, California 94010-1303**

March 19, 2004

Mr. Randall H. Walker
Director of Aviation
Clark County
P.O. Box 11005
Las Vegas, NV 89111-1005

Dear Mr. Walker:

McCarran International Airport; Proposed ATCT sites

Cases: 2004-AWP-41-NRA
2004-AWP-42-NRA
2004-AWP-43-NRA
2004-AWP-44-NRA

This airspace determination is of an advisory nature and is neither permissive nor enabling. It should not be construed to mean FAA approval/disapproval of the physical development involved in the proposal. This is only a determination with respect to the safe and efficient use of airspace.

The Federal Aviation Administration (FAA) has conducted a study of the proposed development under the **Case No.'s 2004-AWP-41-NRA, 2004-AWP-42-NRA, 2004-AWP-43-NRA, and 2004-AWP-44-NRA**. Our review has indicated that we have no objections to the proposed sites for a new Air Traffic Control Tower (ATCT) at McCarran International Airport in Las Vegas, NV.

It will be noted that in a 2/19/2004 teleconference with Mr. Darren Brinker (ANI-540) of the FAA, the LAS ATCT management stated the following:

1. The 2004-AWP-41-NRA site (parking lot) is the 2nd preferred site.
2. The 2004-AWP-42-NRA site (sunset road) is the 4th preferred site.
3. The 2004-AWP-43-NRA site (Terminal 3) is the 1st preferred site. Also if this site consists of plots on both the east and west sides of Kelly Lane, than the preferred site is on the east side of Kelly Lane.
4. The 2004-AWP-44-NRA site (Terminal B) is the 3rd preferred site. Airport personnel have problems with this site because of baggage handling issues.

When the final site selection for the ATCT is made, the following will apply:

Advise the Flight Procedures Office (John Urquhart (310) 725-7123) of the construction dates/schedule at least 14 business days prior to construction so that the appropriate NFDC NOTAMS may be issued.

The proponent is required to coordinate all associated activities with the Airport Manager/Airport Traffic Control Tower (ATCT) in order to ensure the appropriate local NOTAM's are issued whenever men or equipment are adjacent to the runway or other movement areas.

In accordance with the provisions of Advisory Circular 70/7460-1J, **Obstruction Marking and Lighting**, installation of nighttime red obstruction lighting on the ATCT is required.

All temporary construction of a height greater than the proposal shall be filed as a separate notice on FAA Form 7460-1.

We recommend that construction equipment be lowered at night and during other periods of non-use.

It will be noted that our evaluation is limited to airspace utilization and does not address Airport Layout Plan (ALP) or environmental issues. However, this development must now be shown on the next revision to the Airport Layout Plan.

If you have any further questions, please contact Ronald Biaoco at (650) 876-2926.

Sincerely,

Joseph R. Rodriguez
Supervisor, Environmental Safety & Compliance Section

Cc: Mr. Darren Brinker, FAA (ANI-540)

U.S. Department
of Transportation
**Federal Aviation
Administration**

**San Francisco Airports District Office
831 Mitten Road, Room 210
Burlingame, California 94010-1303**

March 24, 2005

Mr. Randall H. Walker
Director of Aviation
Clark County
P.O. Box 11005
Las Vegas, NV 89111-1005

Dear Mr. Walker:

McCarran International Airport; 375' AGL Air Traffic Control Tower; 2005-AWP-2-NRA

This airspace determination is of an advisory nature and is neither permissive nor enabling. It should not be construed to mean FAA approval/disapproval of the physical development involved in the proposal. This is only a determination with respect to the safe and efficient use of airspace and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, state, or local government body.

This determination is based, in part, on the foregoing description that includes a specific height and coordinates for the proposed structure. Any change in coordinates or height will void this determination. Any future construction or alteration, including increase in heights, requires separate notice to the FAA.

The Federal Aviation Administration (FAA) has conducted a study of the proposed work under the Case No. 2005-AWP-2-NRA. Our review has indicated that the proposed 375' AGL Air Traffic Control Tower at this site will penetrate the FAR Part 77.23(a)(2) surface by 54' and the FAR Part 77.25(a) surface by 104'.

We have no objections to the proposed construction of a new 375' AGL Air Traffic Control Tower (ATCT) at this site on McCarran International Airport in Las Vegas, NV provided that obstruction marking and red obstruction lighting is installed on the structure in accordance with the provisions of **Advisory Circular 70/7460-1K, Obstruction Marking and Lighting**.

It will be noted that our evaluation is limited to airspace utilization and does not address Airport Layout Plan (ALP) or environmental issues. However, this development must now be shown on the next revision to the Airport Layout Plan.

The proponent is required to coordinate all associated activities with

the Airport Manager/Airport Traffic Control Tower (ATCT) in order to ensure the appropriate local NOTAM's are issued whenever men or equipment are adjacent to the runway or other movement areas.

All temporary construction of a height greater than the proposal shall be filed as a separate notice on FAA Form 7460-1.

We recommend that construction equipment be lowered at night and during other periods of non-use.

This determination expires on September 24, 2006, unless it is otherwise extended, revised, or terminated, or the facility is constructed before that date. An extension, if necessary, may be requested through our office up to 15 days prior to this expiration date.

If you have any further questions, please contact Ronald Biaoco at (650) 876-2778, ext. 626.

Sincerely,

ORIGINAL SIGNED BY
JOSEPH R. RODRIGUEZ

Joseph R. Rodriguez
Supervisor, Environmental Safety & Compliance
Section

Cc: Mr. Darren Brinker, FAA (ANI-540)

Appendix 6 – Safety Management System (SMS) Report

McCarran International Airport (LAS)

Las Vegas, NV

Safety Risk Management Document
Comparative Safety Assessment
For Airport Traffic Control Tower Siting

April 22, 2005

Comparative Safety Assessment Team Members

Darren Brinker	ANI-540
Richard Shanks	ANI-540
John Urquhart	LAX FPO
Maritza Anderson	AWP-530
Ed Felipe	ANI-940
Terence Griffin	AWP-230
Kathy Peterson	ATO-T Facilities
Rodger Bawgus	AFTIL
John Holman	LAS ATCT
Ky D. Badgley	LAS ATCT
Mikki McAbee	LAS ATCT
George Ivy	LAS ATCT
Jessie Shapiro	AWP-510
Tom Hilquist	PTI/TERPS
Mike Falteisek	ATO-T Safety Office
Dave Cloutier	ATO-T Facilities/SPECTRE

TABLE OF CONTENTS

1.0 Executive Summary

A Comparative Safety Assessment (CSA) has been completed on the Airport Traffic Control Tower (ATCT) Siting for McCarran International Airport (LAS). The purpose of conducting the CSA was to apply the Safety Risk Management (SRM) process defined in the FAA Safety Management System (SMS) Manual, dated May 21, 2004 to the ATCT Siting Process in order to make the LAS ATCT siting report compliant with the goals and objectives of the FAA SMS Manual.

The CSA is a comparison of the relative risk among the three preferred sites as identified in the ATCT Siting Report, McCarran International Airport, Draft Report. A Preliminary Hazard List (PHL) was used to identify the hazards and hazard analysis worksheets were used to document the severity of consequence and likelihood of occurrence to assess the risk. The three preferred sites, as identified in the ATCT Siting Report, McCarran International Airport, Draft Report, were evaluated against each of the system safety hazards identified in the Preliminary Hazard List. The hazards were compared using a Risk Matrix for relative hazard ranking. The CSA only considers hazards that may impact aviation safety.

Findings

Site Terminal 3 presents the most favorable safety profile, based on the lowest relative safety risk ranking. As shown in the Table below, for Site Terminal 3 there were no high-risk hazards, no medium risk hazards, and sixteen (16) low risk hazards. Site Terminal B has one (1) high, no medium risk hazards and fifteen (15) low risk hazards. The high risk hazard was due to the fact that the proposed ATCT and construction equipment will obscure portions of Taxiways Golf, Golf 2, Zulu, Delta, Echo, Foxtrot, Hotel, Sierra, West Ramp, and Runways 19R & 19L. Site C has one (1) medium and fifteen (15) low risk hazards. All Hazards were verified in the Airport Facilities Terminal Integration Laboratory (AFTIL) with the participation of the LAS Air Traffic Control Specialists (ATCS).

CSA Risk Ranking Results

	HI	MED	LO	Comments
Terminal B	1	0	15	
SITE C	0	1	15	
Terminal 3	0	0	16	Safest Relative Site

There were six categories of hazards identified in the PHL. The most significant hazards were associated with impaired visibility of the airport surface movement area. The CSA team evaluated the potential harm of each hazard and then assigned a qualitative likelihood based on the experience of the ATCS at LAS. The risk associated with each hazard was determined from the intersection of severity and likelihood values in the Risk Assessment Matrix (see Figure 4.9 of the SMS Manual).

Identified hazards associated with TERPS and NASWATCH analyses are assumed to be eliminated or mitigated to an acceptable level of risk at the selected site. The SMS requires that hazards be tracked to closure and that all controls and mitigations are validated and verified prior to commissioning the facility. Safety issues shall be considered throughout the design and implementation of the ATCT.

The analysis identified *existing* safety solutions/requirements, which contain "shall" statements that have been validated and verified. These existing requirements are to be incorporated into the siting requirements documentation and in the follow-on processes.

Safety requirements and comparative risk rankings, as identified and listed in this report, must be considered and implemented into the final ATCT site selection of the McCarran International Airport.

The primary materials used in the analysis include:

FAA Order 6480.4, Airport Traffic Control Tower Siting Criteria.

Draft FAA Order 6480.XX, Airport Traffic Control Tower Siting Process.

ATCT Siting Report, McCarran International Airport, Draft Report, the LAS ATCT Siting Team.

FAA Safety Management System (SMS) Manual, dated May 21, 2004.

Participation by operational experts from the LAS ATCT and other subject matter experts.

AFTIL Modeling and Simulation Staff.

2.0 Purpose

The purpose of conducting the CSA was to apply the Safety Risk Management (SRM) process defined in the FAA Safety Management System (SMS) Manual, dated May 21, 2004 to the ATCT Siting Process in order to make the LAS ATCT siting report compliant with the goals and objectives of the SMS Manual.

The CSA is a Comparative Safety Assessment that provides FAA management with an analysis of the identified hazards and a relative risk assessment for the three LAS preferred sites.

3.0 Background

Las Vegas McCarran International Airport (LAS) is located in Clark County approximately 5 miles south of the City of Las Vegas and east of and adjacent to the "Las Vegas Strip." The McCarran airport site covers an area of approximately 3,000 acres. McCarran Field on South Las Vegas Boulevard was constructed and opened for service in December 1948. In March 1963, the terminal building and operations were relocated to its present day location on Paradise Road. McCarran is currently ranked the 7th busiest airport in the nation and is the 2nd busiest airport in terms of originating/destination passenger traffic. In 2003, McCarran accommodated approximately 36.2 million passengers and 501,000 aircraft operations. The passenger total included 35.1 million domestic and 1.1 million international travelers. In 2004, McCarran is averaging an increase of approximately 6 percent in activity. The airport is owned by Clark County, Nevada and operated under the policy direction of the Board of County Commissioners, the authority of the County Manager and the management of the Director and Deputy Director of Aviation.

The airport has four active runways, configured in two sets of parallels. Runways 01R/19L and 01L/19R and Runways 07L/25R and 07R/25L. Runways 25R and 25L are the primary runway for commercial operations and Runways 19r and 19L are predominately used by Corporate and General Aviation aircraft. Runway 01R/19L is constructed of asphalt and is 9,775 feet long and 150 feet wide and is capable of accommodating aircraft weighing up to 877,000 pounds with a dual double tandem gear configuration. Runway 01R is equipped with Runway End Identifier Lights (REIL) and Medium Intensity Runway Lights (MIRL). Runway 19L is also equipped with REIL and MIRL.

Runway 01L/19R is constructed of grooved concrete and is 8,985 feet long and 150 feet wide and is capable of accommodating aircraft weighing up to 833,000 pounds with a dual double tandem gear configuration. Runway 01L is equipped with a Category One (CAT I) Instrument Landing System (ILS), Medium Intensity Approach Lighting System with Sequenced Flashers (MALSF), REIL, and High Intensity Runway Lights (HIRL).

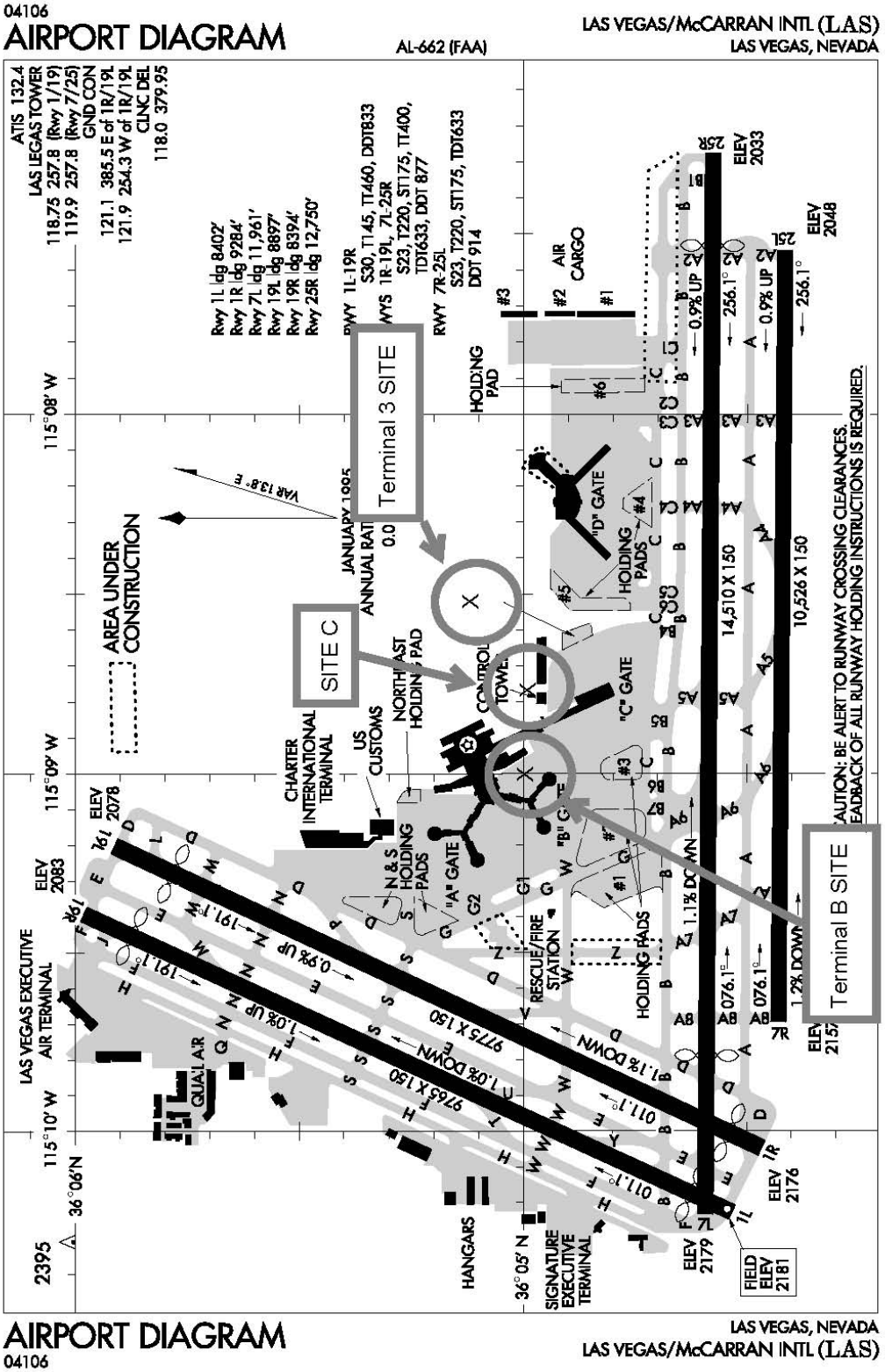
Runway 07L/25R is constructed of asphalt and is 14,510 feet long and 150 feet wide and is capable of accommodating aircraft weighing up to 877,000 pounds with a dual double tandem gear configuration. Runway 07L is equipped with HIRL. Runway 25R is equipped with a CAT I ILS, Medium Intensity Approach Lighting System with Runway Alignment Identifier Lights (MALSR), and HIRL.

Runway 07R/25L is constructed of asphalt and is 10,526 feet long and 150 feet wide and is capable of accommodating aircraft weighing up to 914,000 pounds with a dual double tandem gear configuration. Runway 07R is equipped with REIL and HIRL. Runway 25R is equipped with a CAT I ILS, MALSR, and HIRL.

The current ATCT and Terminal Radar Approach Control (TRACON) facility is owned by the FAA. The ATCT/TRACON buildings are the Welton-Beckett standard commissioned in 1983. The ATCT/TRACON operates as a split facility; the LAS ATCT is a level ten (10) and L30 TRACON is a level eleven (11) facility that operates 24 hours per day, seven days per week and provides service to McCarran International Airport (LAS), and provides approach control for: Henderson Airport (HND) and North Las Vegas Airport (VGT).

A McCarran International Airport ATCT Siting Team was formed and developed a draft ATCT Siting Report. The Siting Report identified three preferred ATCT locations with a final location based on the current tower siting criteria. The findings of this report support the final recommended site location of the ATCT Siting Team.

This CSA was conducted on the three preferred sites concentrating on system safety hazards. The intent was to compare all three sites against an identified set of system safety criteria. The CSA results are included in the LAS ATCT Siting Report. This value-added effort meets the intent and goals of the FAA Safety Management System.


04106
AIRPORT DIAGRAM
AL-662 (FAA)
LAS VEGAS/McCARRAN INTL (LAS)
LAS VEGAS, NEVADA
ATIS 132.4
LAS LEGAS TOWER 118.75 257.8 (Rwy 1/19) 119.9 257.8 (Rwy 7/25)
GND CON 121.1 385.5 E of 1R/19L 121.9 254.3 W of 1R/19L
CLNC DEL 118.0 379.95
Rwy 1L ldg 8402'
Rwy 1R ldg 9284'
Rwy 7L ldg 11,961'
Rwy 19L ldg 8897'
Rwy 19R ldg 8394'
Rwy 25R ldg 12,750'
RWY 1L-19R S30, T145, TT460, DDT833
RWYS 1R-19L, 7L-25R S23, T220, ST175, TT400, TDT633, DDT 877
RWY 7R-25L S23, T220, ST175, TDT633 DDT 914
Terminal 3 SITE
SITE C
Terminal B SITE
AREA UNDER CONSTRUCTION
HOLDING PAD
AIR CARGO
"D" GATE
HOLDING PADS
CONTROL TOWER
"C" GATE
CHARTER INTERNATIONAL TERMINAL
US CUSTOMS
NORTHEAST HOLDING PAD
"A" GATE
N & S HOLDING PADS
"B" GATE
RESCUE/FIRE STATION
HOLDING PADS
LAS VEGAS EXECUTIVE AIR TERMINAL
QUAL AIR
HANGARS
SIGNATURE EXECUTIVE TERMINAL
14,510 X 150
10,526 X 150
9775 X 150
9765 X 150
0.9% UP
1.0% UP
1.0% DOWN
1.1% DOWN
1.2% DOWN
256.1°
076.1°
011.1°
191.1°
ELEV 2033
ELEV 2048
ELEV 2078
ELEV 2083
ELEV 2176
ELEV 2179
FIELD ELEV 2181
2395
36°06'N
36°05'N
115°10' W
115°09' W
115°08' W
CAUTION: BE ALERT TO RUNWAY CROSSING CLEARANCES. EADBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.
AIRPORT DIAGRAM
04106
LAS VEGAS, NEVADA
LAS VEGAS/McCARRAN INTL (LAS)

4.0 Approach and Methodology

The CSA is a comparison of the relative risk among the three preferred sites. It is based on the five (5) step process in the SMS Manual: Describe the System, Identify the Hazards, Analyze the Hazards, Assess the Risk, and Treat the Risk. The CSA is based on the guidance provided in the National Airspace System (NAS) Modernization (MOD) System Safety Management Plan (SSMP) and FAA System Safety Handbook (SSH), as well as knowledge gained from reviewed documents and participation from subject matter experts within LAS and the regional Siting Team. Using this approach 16-system safety hazards were identified.

Describing and Bounding the System
The CSA Team described the system for the LAS ATCT Siting analysis. The system description included the material in the ATCT Siting report and the operational expertise of the LAS ATCS.

Hazard Identification
The CSA Team discussed hazard identification using the ATCT Siting PHL. The CSA Team validated and further expanded the ATCT Siting PHL.

Hazard Analysis
Using the CSA Worksheets, the CSA Team held a discussion on each of the identified hazards. The purpose of this discussion was to examine the hazard causes and to validate the severity of consequence for the hazards on the PHL, and to assign a qualitative likelihood of occurrence based on the expertise of the LAS ATCS and all available data. It soon became apparent that a quantitative approach was not possible due to the lack of specific data for each assessed hazard. The bow-tie model adapted for this analysis takes the hazards identified in the PHL and the hazard worksheets and presents a visual model of the relationships among the causal factors and the potential outcomes under defined system states. The left side of the bow tie is a fault tree while the right side of the bow tie an event sequence diagram. The bow-tie models can be found in Attachment B.

Risk Determination
Risk is the composite of predicted severity and likelihood of the potential effect of a hazard in the worst credible system state. Risk is determined by two factors, severity of consequence and the likelihood of occurrence. Risk is not determined simply by the likelihood that the hazard will occur, but that the worst credible outcome will occur. The CSA relied upon the input from operational experts within LAS and the ATCT Siting Team; the final likelihood determinations are qualitative.

Identified hazards associated with TERPS and NASWATCH analyses are assumed to be eliminated or mitigated to an acceptable level of risk at the

selected site. The SMS requires that medium and high hazards be tracked to closure and that all medium and high risk related controls and mitigations are validated and verified prior to commissioning the facility. Safety issues shall be considered throughout the design and implementation of the ATCT.

The ATCT CSA Siting Report uses criteria identified in the FAA SMS Manual for both severity of consequence and likelihood of occurrence. These criteria are listed in the SMS Manual and found in tables 4.2 and 4.3, respectively.

The Risk Assessment Matrix and criteria for risk acceptability are found in the SMS Manual in Figure 4.9.

The logic paths used in developing the hazard descriptions is presented in a visual bow-tie model, located in Attachment B. The hazard severity and likelihood rationales are also developed using the bow-tie method described in the FAA SMS. The bow-tie model illustrates the hazard causes, in a fault tree layout, on the left side of the model, with the hazard system states depicted to the right side of the hazard. Following a causal pathway, from the left side of the model through the hazards, and right-side selected worst-case system states, an event flow is determined. Hazard end states are determined to be credible or not credible based on the expected frequency of occurrence determined by the LAS ATCS.

Risk Treatment

For each hazard, the CSA Team identified existing requirements and solutions that mitigate or control the hazards. It is recommended that a more detailed safety assessment be performed for the selected site to identify any additional safety requirements/solutions. The SMS requires that all high and medium risk hazards be tracked to closure and that all medium and high risk related controls and mitigations have been validated and verified prior to commissioning the facility. After the hazards were defined and possible effects were identified, means to control the hazards were defined. The approach taken was based on the Safety Order of Precedence, depicted in Table 4.4 in the SMS Manual.

5.0 Analysis

Implementing the methodology described in the previous section, 16 hazards were identified.

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
4	TERPS violations ATCT siting impacts TERPS airspace.	ATCT is too tall for existing and / or planned airspace requirements	During IMC operations	Slight reduction in safety margin	Sites Terminal B, C & Terminal 3 5 No Safety Effect	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-5a (4) 6480.4-2b (1d) Lower the ATCT to be below the design surfaces ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and, altitude. FAR 91.63, 91.75, 91.85, 97 Increase minimas to adjust the design surfaces so that the ATCT is TERPS compliant	5E Extremely improbable (verified by TERPS analysis) **(Low Risk Hazard)**	5E Extremely improbable (verified by TERPS analysis) **(Low Risk Hazard)**	5E Extremely improbable (verified by TERPS analysis) **(Low Risk Hazard)**

The Hazard-specific number is in column 1. It is the specific identifier for that Hazard Description. The second column is the Hazard Description. A narrative of the causes is in the third column. The system state is located in column 4 with the possible effect in column 5. Column 6 contains the severity / rationale. Column 7 shows the existing safety solutions. Columns 8, 9, and 10 represent relative risk rankings for the preferred sites Terminal B, C, and Terminal 3 respectively.

6.0 Assumptions

The assumptions associated with the ATCT CSA Siting Report are discussed below:

1. Any changes to the ATCT Siting Report for the Las Vegas McCarran CSA DAR will be made upon concurrence of the FAA Regional Siting Team.

2. It is expected that risk will increase should the existing safety solutions not be followed or implemented.

3. The CSA is not all-inclusive in that there may be unknown hazards within any operation or process.

4. The mitigating controls will be implemented and verified.

7.0 ATCT Siting Criteria from FAA Order 6480.4

The following criteria were used as a basis for development of the PHL. These criteria were derived from FAA Order 6480.4 and Draft Order 6480.XX.

Table 1 – ATCT Siting Criteria

Criteria for NAS hazards 001 through 016
Siting Requirements – All requirements shall be based on the current approved Airport Layout Plan (ALP).
Unobstructed View – Visibility from the ATCT Cab shall be an unobstructed view of all controlled movement areas of an airport, including all runways, taxiways, and all other landing areas, and of air traffic in the vicinity of the airport.
Object Discrimination – ATCT distance from critical airport locations and ATCT height must support requirements for object visibility from the ATCT cab.
Two-Point Lateral Discrimination – Consideration should be given to the two-point lateral discrimination to ensure that ATCT siting and height enhances visibility performance as much as possible.
Terminal Instrument Procedures (TERPS) - The ATCT shall be sited such that it will not derogate any current or planned instrument approach minimums.
Airport Imagery - Federal Aviation Regulations, 14 CFR Part 77, Objects Affecting Navigable Airspace, including all amendments, shall be complied with as applicable.
Equipment - The ATCT shall be sited where it will not degrade or be affected by the performance of existing or planned communications, navigation, and surveillance facilities and equipment.
ATCT Cab Orientation - must consider the following; direct sun glare, indirect sun glare off of natural and manmade surfaces, night-time lighting glare, and external light sources.
Weather - Consideration must be given to local weather phenomena and historical meteorological data that impair visibility.
Look-down Angle – Consideration must be given to look-down angle due to the potential of a larger cab and/or taller ATCT.
Look Across Line-of-Site (LOS) – Consideration must be given to visibility from operational positions in the ATCT cab and potential impacts to line-of-site due to an increase in cab size and/or ATCT height.
Mullions – Consideration must be given to LOS impacts resulting from placement and configuration of mullions. (Design Issue)

Look-up Angle for Missed Approaches – Consideration must be given to look-up angle fro adverse impacts on air traffic operations.
Construction – Consideration must be given to line of sight during construction activities of the proposed ATCT.
Access – Access to the ATCT must avoid crossing areas of aircraft operations.
Non-Movement Areas - Visibility of all airport surface areas for ground operations of aircraft and of airport ground vehicles on ramps, aprons and tie down areas, and test areas must be considered.

8.0 Comparative Safety Assessment Findings

The results of the CSA yielded that Site Terminal 3 was the safest relative site with sixteen (16) low risk hazards. As shown in the Table below, site Terminal B has one (1) high risk hazard, and fifteen (15) low risk hazards. The high risk hazard was due to the fact that the proposed ATCT and construction equipment will obscure portions of Taxiways G2, G, Z, D, E, F, H, S, west ramp, and Runways 19R & 19L. Site C has one (1) medium risk hazard, and fifteen (15) low risk hazards. All hazards were verified in the Airport Facilities Terminal Integration Laboratory (AFTIL) with the participation of the LAS ATCS.

Table 2 – CSA Results

	HI	MED	LO
Terminal B	1	0	15
SITE C	0	1	15
Terminal 3	0	0	16

Risk Assessment Ratings

A risk assessment matrix with the results of the CSA plotted is shown in Figure 2 below. The legend is shown below the figure for differentiation of each preferred site. The number inside the symbol is the number of hazards in each cell of the matrix. The location of each symbol on the matrix in the red, yellow, or green regions determines the risk associated with the hazard. For example, cell 5E of the matrix contains a circle, triangle, and square representing sites Terminal B, C, and Terminal 3 respectively. As indicated, site Terminal B has ten (10) low risk hazards of this severity and frequency, site C has ten (10) low risk hazards of this severity and frequency, and site Terminal 3 has twelve (12) low risk hazards of this severity and frequency.

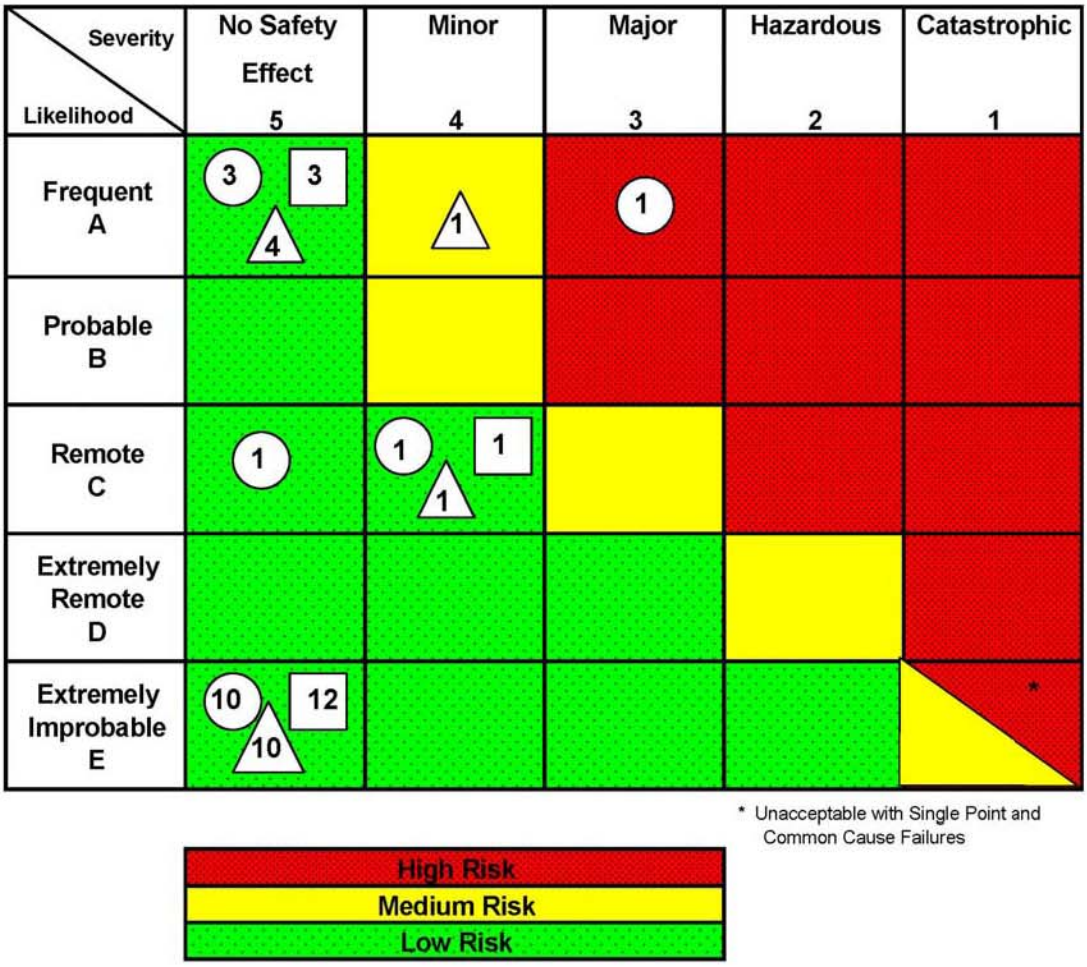


Figure 2 - Assessment of Risk Associated with CSA Hazards

Assigned risk ratings are determined assuming the employment of existing safety solutions in Section 7.0. The assigned risk ratings are comparative risk ratings, not absolute risk ratings. The Comparative Safety Assessment considers the impact of differences in the proposed ATCT sites.

The CSA in Attachment A contains the 16 Hazard Classification Worksheets, one for each hazard. These worksheets contain the rationale for both the severity and likelihood for all 3 (three) site alternatives.

9.0 Conclusion

Site Terminal 3 presents the most favorable safety profile, based on the lowest relative safety risk ranking. However, it is recommended that further analysis be conducted after construction and prior to commissioning to verify findings.

Attachment A - Hazard Description Tabular Worksheets

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
1	Potential interference with navigation, equipment (both planned and existing equipment). Interference with NAS equipment generates hazardously misleading information, followed by loss of situational awareness leading to loss of separation between two moving aircraft/ vehicles	Structural E3 interference from new tower location Line of Sight	During IFR / IMC operations.	Interference with NAS equipment generates hazardously misleading information, followed by loss of situational awareness. Loss of separation	Sites Terminal B, C & Terminal 3 5 – No Safety Effect Based on the operational expertise of the NAS watch specialist	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-5a (5) Radar environment FAA Order 7400.2E Objects Effecting Navigable Airspace ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97 Other NAVAIDS (e.g. GPS)	5C Remote due to the NASWATCH screening tool revealed that navigation interference issues at this site were negligible. (no impact verified by NAS – watch study) **(Low Risk Hazard)**	5A Frequent due to the NASWATCH screening tool revealed that navigation interference issues at this site were negligible. (no impact verified by NAS – watch study) **(Low Risk Hazard)**	5A Frequent due to the NASWATCH screening tool revealed that navigation interference issues at this site were negligible. (no impact verified by NAS – watch study) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
2	Potential interference with communication equipment (both planned and existing equipment).	Structural E3 interference from new tower location	During both VMC and IMC operations, including departures and approaches, up to and including CAT II, and surface procedures.	Interference with NAS equipment generates loss of communication.	Sites Terminal B, C & Terminal 3 5 – No Safety Effect Based on the operational expertise of the NAS watch specialist	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-5a (5) Radar environment ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97 FAA Order 7400.2E Objects Effecting Navigable Airspace	5E extremely improbable due to the NASWATCH screening tool revealed no communication interference issues at this site (no impact verified by NAS – watch study) **(Low Risk Hazard)**	5E extremely improbable due to the NASWATCH screening tool revealed no communication interference issues at this site (no impact verified by NAS – watch study) **(Low Risk Hazard)**	5E extremely improbable due to the NASWATCH screening tool revealed no communication interference issues at this site (no impact verified by NAS – watch study) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
3	Potential interference with existing and / or proposed surveillance equipment. ASR-9 – existing	Position of ATCT generates electromagnetic interference with NAVAIDS	During both VMC and IMC operations, including departures and approaches.	Ghost targets Areas without radar coverage	Sites Terminal B, C & Terminal 3 5 – No Safety Effect Based on the operational expertise of the NAS watch specialist	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-5a (5) Radar environment ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97 FAA Order 7400.2E Objects Effecting Navigable Airspace	5E extremely improbable due to the NAS Watch screening tool revealed no surveillance interference issues at this site (No impact verified by NAS – watch study) **(Low Risk Hazard)**	5E extremely improbable due to the NAS Watch screening tool revealed no surveillance interference issues at this site (No impact verified by NAS – watch study) **(Low Risk Hazard)**	5E extremely improbable due to the NAS Watch screening tool revealed no surveillance interference issues at this site (No impact verified by NAS – watch study) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
4	TERPS violations Tower siting impacts TERPS airspace.	Tower is too tall for existing and / or planned airspace requirements	During IMC operations	Slight reduction in safety margin	Sites Terminal B, C & Terminal 3 5 No Safety Effect Based on the TERPS analysis	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-5a (4) 6480.4-2b (1d) Lower the tower to be below the design surfaces ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and, altitude. FAR 91.63, 91.75, 91.85, 97 Increase minimas to adjust the design surfaces so that the tower is TERPS compliant	5E Extremely improbable No Impact (verified by TERPS analysis) **(Low Risk Hazard)**	5E Extremely improbable No impact (verified by TERPS analysis) **(Low Risk Hazard)**	5E Extremely improbable No impact (verified by TERPS analysis) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
5	Direction of visual field create sight limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Direction of view (Northern Hemisphere): North East West South	During both VMC and IMC operations. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload for ATCS Direction of view causes sight limitations causing ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Based on operational ATC experience of the LAS ATCS (verified in the AFTIL)	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b(2a) The Human Factors Design Standard HF-STD-001 Airway Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5A Frequent based on operational experience of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5A Frequent based on operational experience of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5A Frequent based on operational experience of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
6	Line of sight / Angle of View create visual sight limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Up Down 35` minute of view	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload for ATCS Line of sight angle causes sight limitations causing ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Slight increase in ATCS and/or pilot workload based on the operational expertise of the LAS ATCS Operator can FAR 91.63, 91.75, 91.85, 97	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-3a(2) The Human Factors Design Standard HF-STD-001 Airway Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5E Extremely improbable based on operational ATC experience of LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E Extremely improbable based on operational ATC experience of LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E Extremely improbable based on operational ATC experience of LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
7	Distance of view creates visual sight limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	ATC depth perception ATC distance acuity Background clutter Loss of visual contact or merging/ hiding of objects leading to loss of situational awareness and loss of separation Dusk Dawn Low lighting	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Significant increase in ATC workload Distance of view causes ATCS to lose situational awareness. Loss of situational awareness allows loss of separation.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Slight increase in ATCS and/or pilot workload based on the operational expertise of the LAS ATCS.	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2a, 3a 6480.4-2b (2a) The Human Factors Design Standard HF-STD-001 Airway Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5E Extremely improbable based on operational ATC experience of LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E Extremely improbable based on operational ATC experience of LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E Extremely improbable based on operational ATC experience of LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
8	Sunlight/ Daylight create lighting/ atmospheric sight limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Sun Angle Sun Glare Sun Shadows Thermal Distortion Light changes/ contrast eye adaptation Loss of visual contact or merging/ hiding of objects leading to loss of situational awareness and loss of separation	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload for ATCS Sunlight/ daylight cause sight limitations causing ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Slight increase in ATCS and/or pilot workload based on the operational expertise of the LAS ATCS Operator can FAR 91.63, 91.75, 91.85, 97 D-Brite Sun shades / blinds Double shades as required on east & west sides of cab Sun glasses	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b (2b)(2c) 6480.4-5c (5) 6480.4-2b (2b)(2c) 6480.4-2b (2b)(2c) 6480.4-5c (5) The Human Factors Design Standard HF-STD-001 Airway Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center ATCS shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5A Frequent Based on operational experience of the LAS ATCS Operator can see and avoid D-Brite Sun shades / blinds Sun glasses **(Low Risk Hazard)**	5A Frequent Based on operational experience of the LAS ATCS Operator can see and avoid D-Brite Sun shades / blinds Sun glasses **(Low Risk Hazard)**	5A Frequent Based on operational experience of the LAS ATCS Operator can see and avoid D-Brite Sun shades / blinds Sun glasses **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
9	Artificial lighting create sight limitations (ground) Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Airport lighting equipment outages Lighting shadows Airport lighting Construction lighting Residential / industrial lighting Background clutter Loss of visual contact or merging/ hiding of objects leading to loss of situational awareness and loss of separation	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload for ATCS Artificial lighting causes sight limitations causing ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Slight increase in ATCS and/or pilot workload based on the operational expertise of the LAS ATCS No ground radar 2-D Based on LAS current configuration	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b (2c) The Human Factors Design Standard HF-STD-001 ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5A Frequent Possible light contamination from Delta gates and cargo gates obscuring portions of Taxiway Charlie, Charlie 2, and Charlie 3. Based on operational experience of the LAS ATCS **(Low Risk Hazard)**	5A Frequent Possible light contamination from Delta gates and cargo gates obscuring portions of Taxiway Charlie, Charlie 2, and Charlie 3. Based on operational experience of the LAS ATCS **(Low Risk Hazard)**	5E Extremely Improbable Based on operational experience of the LAS ATCS **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
9a	Artificial lighting create sight limitations (airborne) Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Airport lighting equipment outages Municipal lighting Industrial lighting Airport lighting Construction lighting Loss of visual contact or merging/ hiding of objects leading to loss of situational awareness and loss of separation	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload Artificial light causes ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation not identified and not corrected in time to prevent accident	Sites Terminal B, C & Terminal 3 5 No Safety Effect Slight increase in ATCS and/or pilot workload based on the operational expertise of the LAS ATCS D-brite Pilot has more ability to maneuver 3-D Separation minima	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b (2c) The Human Factors Design Standard HF-STD-001 ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5E Extremely Improbable Based on operational experience of the LAS ATCS D-brite Pilot has more ability to maneuver 3-D Separation minima **(Low Risk Hazard)**	5E Extremely Improbable Based on operational experience of the LAS ATCS D-brite Pilot has more ability to maneuver 3-D Separation minima **(Low Risk Hazard)**	5E Extremely Improbable Based on operational experience of the LAS ATCS D-brite Pilot has more ability to maneuver 3-D Separation minima **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
10	Naturally occurring atmospheric conditions create site limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Dust Ash Smoke Haze Fog Rain Sleet Snow Sun glare off of snow Naturally occurring Cloud layer minimum ceiling heights (Historical data) Loss of visual contact or merging/ hiding of objects leading to loss of situational awareness and loss of separation	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload for ATCS Naturally occurring atmospheric conditions cause sight limitations causing ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 4 Minor Slight reduction in ATC capability, or significant increase in ATCS Workload. Pilot qualifications / certifications Aircraft equipage ATCS common practice to verify aircraft/ vehicle position	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b (2c) (2e) 6480.4-2b (2b)(2c) FAA Order: 7110.65 FAR 91.75, FAR 91.85, FAR 97, and FAR 91.63 ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude.	4C Remote Based on the operational expertise of the LAS ATCS During high winds, dust obscures airport movement surfaces **(Low Risk Hazard)**	4C Remote Based on the operational expertise of the LAS ATCS During high winds, dust obscures airport movement surfaces **(Low Risk Hazard)**	4C Remote Based on the operational expertise of the LAS ATCS During high winds, dust obscures airport movement surfaces **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
11	Industrial/ municipal discharges to the atmosphere create site limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Industrial Dust Industrial Fumes Industrial Ash Industrial Smoke Loss of visual contact or merging/ hiding of objects leading to loss of situational awareness and loss of separation	During both VMC and IMC operations, including departures and approaches. Where visual acuity, depth perception, and object and color differentiation are critical.	Increase in workload for ATCS Industrial/ municipal discharges to the atmospheres causes sight limitations causing ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Based on the operational expertise of the LAS ATCS Non-issue at LAS	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b (2c) (2e)(2i) ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
12	Access to proposed site does not cross existing ground / air traffic patterns Two moving aircraft/ vehicles on collision vectors or one moving aircraft/ vehicle on a collision vector with a stationary object	Limited Site selection locations Political considerations Economic considerations	During both VMC and IMC operations, including departures and approaches. During peak operational and traffic times.	Loss of visual contact or merging/ Hiding of objects leading to loss of situational awareness and loss of separation	Sites Terminal B, C & Terminal 3 5 No Safety Effect Based on the operational expertise of the LAS ATCS Non-issue at LAS	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-2b (2g) ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, altitude. FAR 91.63, 91.75, 91.85, 97 Airport Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

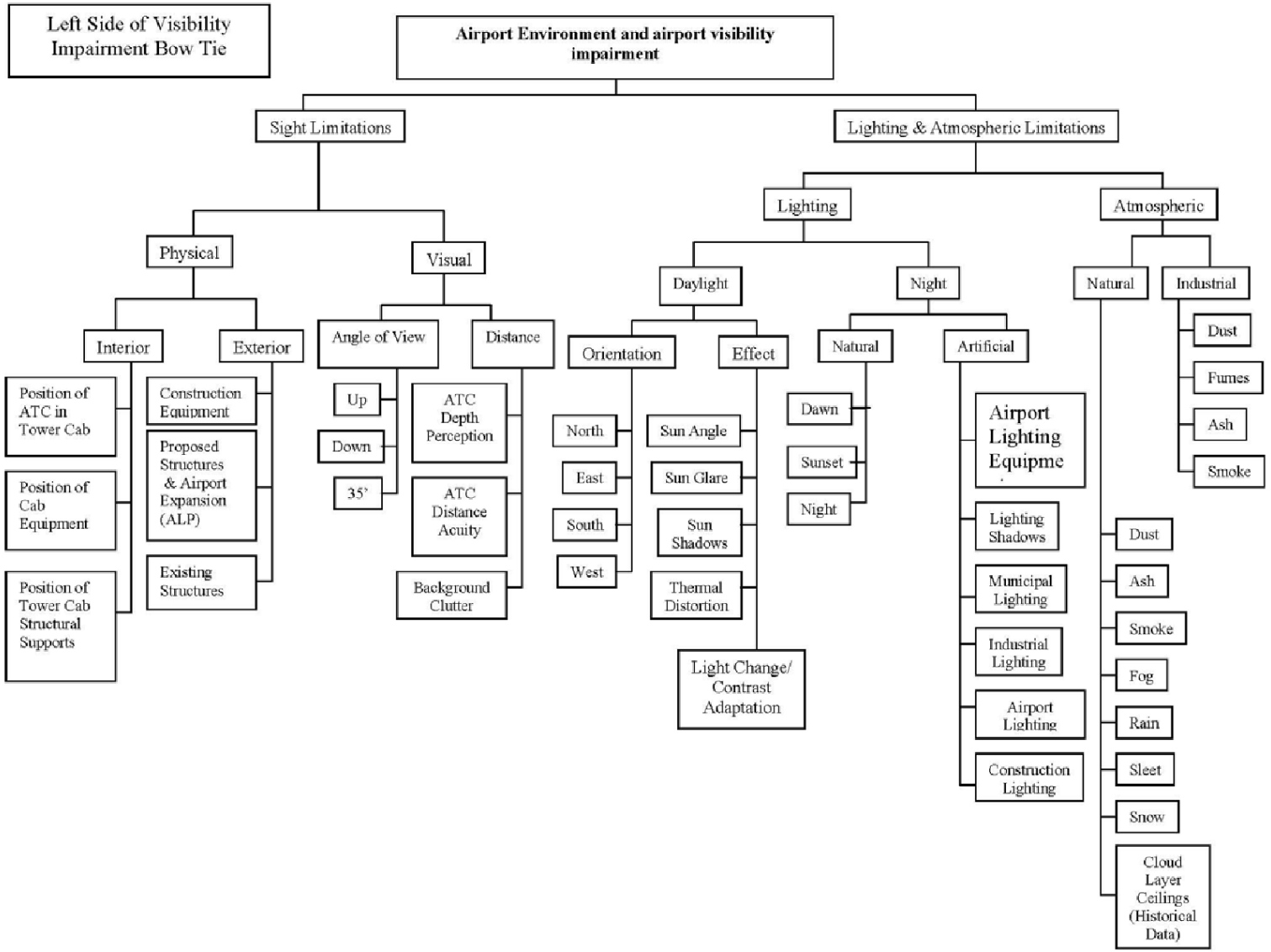
Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
13	Interior physical barriers create sight limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Position of ATC in Tower Cab limits view angles/line of sight Position of Tower Cab equipment limits view angles/line of sight Position of Tower Cab structural supports limits view angles/line of sight (Loss of visual contact leading to loss of situational awareness and loss of separation)	During both VMC and IMC operations.	Increase in workload for ATCS Partially blocked field of vision causes ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Sites Terminal B, C & Terminal 3 5 No Safety Effect Based on the operational expertise of the LAS ATCS Non-issue at LAS ATCS must move to see past mullion	ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97 The Human Factors Design Standard HF-STD-001 FAA Order: The Airport Traffic Control Siting Criteria 6480.4-1a, 3b 6480.4-2a, b, c, d 6480.4-1a, 1b, 3a 6480.4-2c Airport Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**	5E No Safety Effect Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

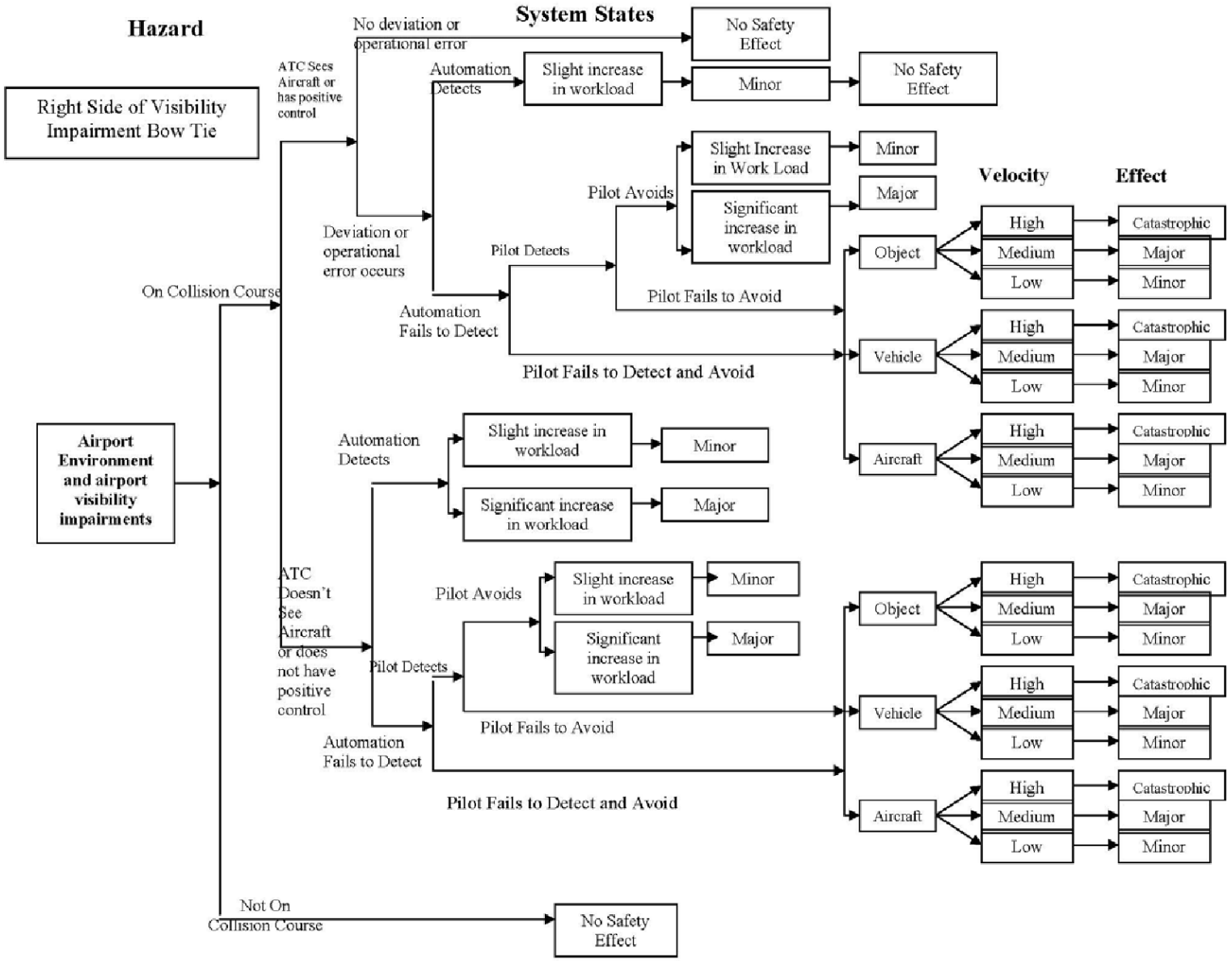
Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
14	Exterior physical barriers create sight limitations Loss of visual contact leads to loss of situational awareness and loss of separation between two moving aircraft/ vehicles.	Construction equipment limits line of sight Proposed new structures and Airport expansions (ALP) limits line of sight Existing structures limits line of sight (Loss of visual contact leading to loss of situational awareness and loss of separation)	During both VMC and IMC operations.	Increase in workload for ATCS Partially blocked field of vision causes ATCS to lose situational awareness. Loss of situational awareness allows loss of separation. Loss of separation requires ATCS actions to correct.	Site Terminal B 3 Major Significant reduction in separation or significant reduction in ATC capability based on the operational expertise of the LAS ATCS Site C 4 Minor Slight reduction in ATC capability or significant increase in ATC workload based on the operational expertise of the LAS ATCS Site Terminal 3 5 No Safety effect Non-issue. Rationale is based on the operational expertise of the LAS ATCS and verified in the AFTIL	ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and altitude. FAR 91.63, 91.75, 91.85, 97 The Human Factors Design Standard HF-STD-001 FAA Order: The Airport Traffic Control Siting Criteria 6480.4-1a, 3b 6480.4-2a(1b)(1c) 6480.4-2b(1a)(1b)(1c) 6480.4-1c, 2b(2h) Airport Facilities Terminal Integration Laboratory (AFTIL), FAA Tech Center	3A Frequent Based on the operational expertise of the LAS ATCS New ATCT construction will obscure portions of Taxiways Golf, Golf 2, Zulu, Delta, Echo, Foxtrot, Hotel, Sierra, West Ramp, and Runways 19R & 19L (verified in the AFTIL) **(High Risk Hazard)**	4A Frequent Based on the operational expertise of the LAS ATCS New ATCT construction will obscure aircraft on left base approach to Runways 19L & 19R (verified in the AFTIL) **(Medium Risk Hazard)**	5E Extremely Improbable Based on the operational expertise of the LAS ATCS (verified in the AFTIL) **(Low Risk Hazard)**

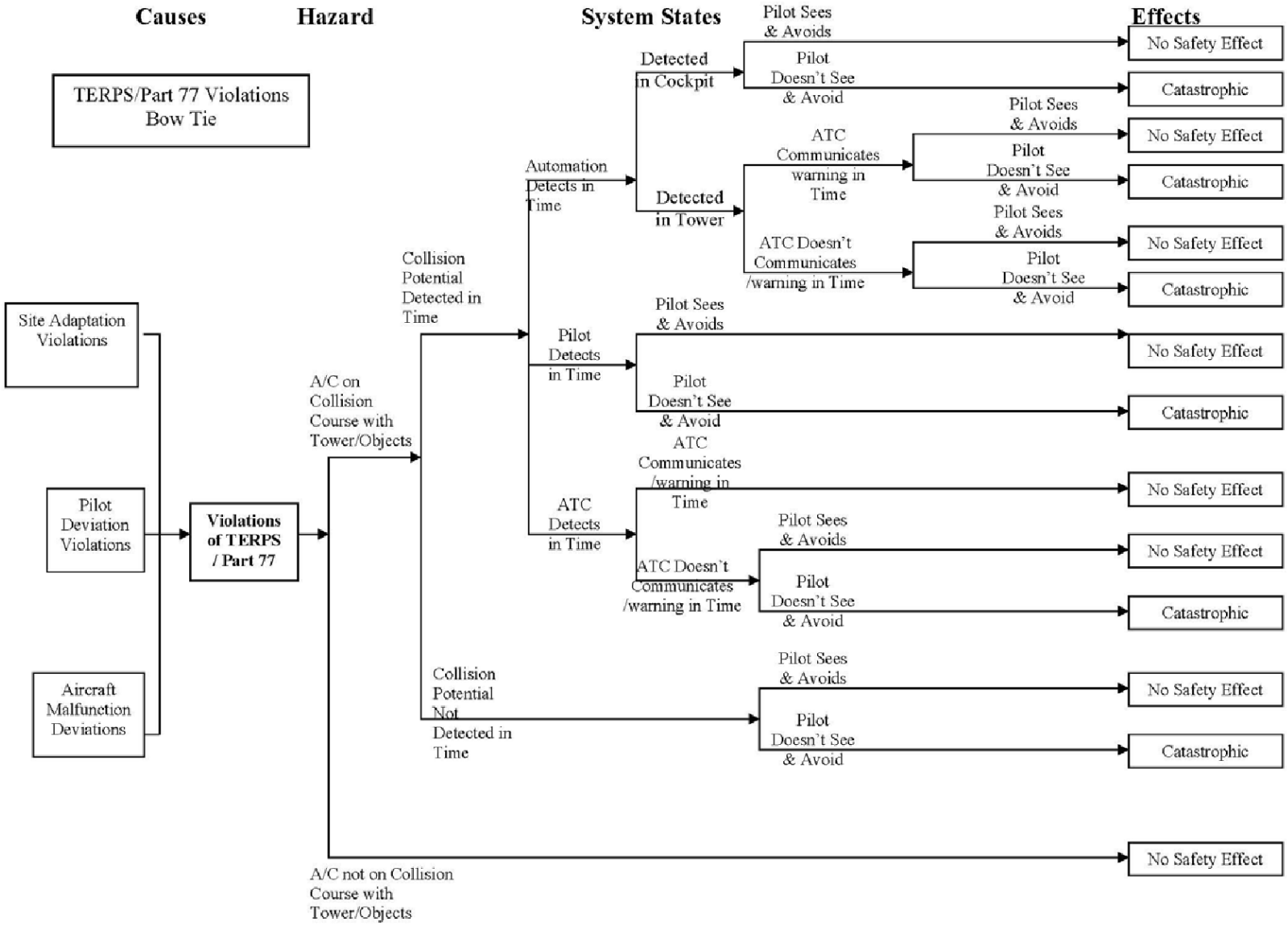
Hazard# (1)	Hazard Description (2)	Causes (3)	System State (4)	Possible Effect (5)	Severity/ Rationale (6)	Existing Safety Solutions (7)	Site Terminal B	Site C	Site Terminal 3
15	Part 77 violations Objects that affect navigable airspace	ATCT is too tall for existing and / or planned airspace requirements	During IMC operations	Slight reduction in safety margin	Sites Terminal B, C & Terminal 3 5 No Safety Effect Based on San Francisco Airports District Office (SF ADO) analysis. **Mark & Light ATCT**	FAA Order: The Airport Traffic Control Siting Criteria 6480.4-5a (4) 6480.4-2b (1d) Lower the tower to be below the design surfaces ATCT shall use 7110.65 procedures for validating and/or verifying aircraft ID, position, and, altitude. FAR 91.63, 91.75, 91.85, 97 Increase minimas to adjust the design surfaces so that the tower is TERPS compliant	5E Extremely improbable due to no objections from SF ADO after a Part-77 analysis. **(Low Risk Hazard)** **Mark & Light ATCT**	5E Extremely improbable due to no objections from SF ADO after a Part-77 analysis. **(Low Risk Hazard)** **Mark & Light ATCT**	5E Extremely improbable due to no objections from SF ADO after a Part-77 analysis. **(Low Risk Hazard)** **Mark & Light ATCT**

Attachment B - Bow Tie Models

Causes


Left Side of Visibility Impairment Bow Tie
Airport Environment and airport visibility impairment
Sight Limitations
Lighting & Atmospheric Limitations
Physical
Visual
Lighting
Atmospheric
Interior
Exterior
Angle of View
Distance
Daylight
Night
Natural
Industrial
Position of ATC in Tower Cab
Position of Cab Equipment
Position of Tower Cab Structural Supports
Construction Equipment
Proposed Structures & Airport Expansion (ALP)
Existing Structures
Up
Down
35'
ATC Depth Perception
ATC Distance Acuity
Background Clutter
Orientation
Effect
North
East
South
West
Sun Angle
Sun Glare
Sun Shadows
Thermal Distortion
Light Change/ Contrast Adaptation
Natural
Artificial
Dawn
Sunset
Night
Airport Lighting Equipme
Lighting Shadows
Municipal Lighting
Industrial Lighting
Airport Lighting
Construction Lighting
Dust
Fumes
Ash
Smoke
Dust
Ash
Smoke
Fog
Rain
Sleet
Snow
Cloud Layer Ceilings (Historical Data)


Hazard
Right Side of Visibility Impairment Bow Tie
System States
No deviation or operational error
No Safety Effect
ATC Sees Aircraft or has positive control
Automation Detects
Slight increase in workload
Minor
No Safety Effect
Slight Increase in Work Load
Minor
Pilot Avoids
Major
Significant increase in workload
Deviation or operational error occurs
Pilot Detects
Velocity
Effect
Object
High
Medium
Low
Catastrophic
Major
Minor
On Collision Course
Pilot Fails to Avoid
Automation Fails to Detect
Vehicle
Pilot Fails to Detect and Avoid
Airport Environment and airport visibility impairments
Automation Detects
Slight increase in workload
Minor
Significant increase in workload
Major
Aircraft
ATC Doesn't See Aircraft or does not have positive control
Pilot Avoids
Slight increase in workload
Minor
Significant increase in workload
Major
Pilot Detects
Pilot Fails to Avoid
Automation Fails to Detect
Pilot Fails to Detect and Avoid
Not On Collision Course
No Safety Effect


Causes
Hazard
System States
Effects
TERPS/Part 77 Violations Bow Tie
Site Adaptation Violations
Pilot Deviation Violations
Aircraft Malfunction Deviations
Violations of TERPS / Part 77
A/C on Collision Course with Tower/Objects
A/C not on Collision Course with Tower/Objects
Collision Potential Detected in Time
Collision Potential Not Detected in Time
Automation Detects in Time
Detected in Cockpit
Detected in Tower
Pilot Sees & Avoids
Pilot Doesn't See & Avoid
ATC Communicates warning in Time
ATC Doesn't Communicates /warning in Time
Pilot Detects in Time
ATC Detects in Time
ATC Communicates /warning in Time
ATC Doesn't Communicates /warning in Time
No Safety Effect
Catastrophic

Attachment C - Acronyms

Acronyms

2-D – Two Dimensional
3-D – Three Dimensional
ADO – Airports District Office
AFTIL – Airport Facilities Terminal Integration Laboratory
ALP – Airport Layout Plan
ANI – NAS Implementation Directorate
ASR – Airport Surveillance Radar
ATC – Air Traffic Control
ATCS – Air Traffic Control Specialist
ATCT – Airport Traffic Control Tower
ATO – Air Traffic Organization
AWP – Western-Pacific Region
LAS – McCarran International Airport
LAX – Los Angeles International Airport
CAT – Category
CFR – Code of Federal Regulations
COM – Communications
CSA – Comparative Safety Assessment
DAR – Design Analysis Report
F & E – Facilities and Equipment
FAA – Federal Aviation Administration
FAR – Federal Aviation Regulation
FPO – Flight Procedures Office
GPS – Global Positioning System
GS – Glide Slope
HAA – Height Above Airport
HAT – Height Above Touchdown
HI – High
HIRL – High Intensity Runway Lights
HND – Henderson Airport
ILS – Instrument Landing System
IMC – Instrument Meteorological Conditions
IFR – Instrument Flight Rules
L30 – Las Vegas TRACON
LO – Low
LOC – Localizer
LOS – Line of Sight
MALSF – Medium Intensity Approach Lighting System with Sequenced Flashers

MALSR – Medium Intensity Approach Lighting System with Runway Alignment Identifier Lights
MDA – Minimum Decision Altitude
MED – Medium
MOD – Modernization
NAS – National Airspace System
NASWATCH – Airway Facilities Radio Frequency Screening Tool
NAV – Navigation
NMAC – Near Mid-Air Collision
PHL – Preliminary Hazard List
RAC – Risk Assessment Code
RVR – Runway Visual Range
RWY – Runway
SF ADO – San Francisco Airports District Office
SMS – Safety Management System
SRM – Safety Risk Management
SSH – System Safety Handbook
SSMP – System Safety Management Plan
TERPS – Terminal Instrument Procedures
TRACON – Terminal Radar Approach Control
VFR – Visual Flight Rules
VGT – North Las Vegas Airport
VHF – Very High Frequency
VMC – Visual Meteorological Conditions
VNAV – Vertical Navigation
VOR – VHF Omni-Directional Range

Attachment D – Resources

Las Vegas McCarran ATCT Siting Resources

FAA Order 6480.4, Airport Traffic Control Tower Siting Criteria.

Proposed FAA Order 6480.XX, Airport Traffic Control Tower Siting Criteria.

ATCT Siting Report, McCarran International Airport, Draft Report, the LAS ATCT Siting Team.

TERPS Analysis

NASWATCH Analysis

Operational expertise of the LAS ATCS.

AFTIL Modeling and Simulation Staff.